Volume 2, No. 7 JULY, 1920 OLD SERIES, Vol. XVIII, No. 7

The Journal of Orthopædic Surgery

The Official Publication of the
American Orthopedic Association
and of the
British Orthopaedic Association

PUBLISHED ON THE FIFTH DAY OF EACH MONTH AT LINCOLN, NEBRASKA, U. S. A.
FOUR DOLLARS PER ANNUM
Entered as Second Class Matter in the Post Office at Lincoln, Nebraska

For the
British Orthopædic Association
Editor
R. C. ELMSLIE, M.S., F.R.C.S.
Editorial Committee
T. R. ARMOUR, F.R.C.S.
W. H. TRETHOWAN, F.R.C.S.
H. PLATT, M.S., F.R.C.S.

For the
American Orthopedic Association
Editor
H. WINNETT ORR, M. D., F. A. C. S.
Editorial Committee
JOHN L. PORTER, M. D., F. A. C. S.
F. J. GAENSLEN, B. Sc., F. A. C. S.
EDWIN W. RYERSON, M. D., F. A. C. S.

TABLE OF CONTENTS

PRESIDENT'S ADDRESS AT THE ANNUAL MEETING OF THE AMERICAN ORTHOPEDIC ASSOCIATION AT TORONTO, JUNE 7-10, 1920. Clarence L. Starr, M. D., Col. C. A. M. C., Toronto, Canada 381

THE OPEN OPERATION FOR CONGENITAL DISLOCATION OF THE HIP. Herbert P. H. Galloway, M. D., C. M., F. A. C. S., Winnipeg, Manitoba 390

THE VARIATIONS IN THE ANATOMIC STRUCTURE OF THE LUMBAR SPINE. Joel E. Goldthwait, M. D., Boston 416

OFFICERS OF THE AMERICAN ORTHOPEDIC ASSOCIATION 1920-1921 435

EDITORIAL 436

ORTHOPAEDIC TITLES IN CURRENT LITERATURE 437

CURRENT ORTHOPAEDIC LITERATURE 442

ROBERT LINDER

Manufacturers of

Orthopedic Appliances

Hip Splints, Arm Splints, Knee Splints,
Bow-Leg Braces, Knock-Knee Braces,
Spine and Shoulder Braces,
and Flat-Foot Soles

ELASTIC STOCKINGS and TRUSSES
of every description

No. 148 East 53rd Street, New York

Vol. 2, No. 7 JULY, 1920 Old Series: Vol. xviii, No. 7

The Journal of Orthopædic Surgery

PRESIDENT'S ADDRESS AT THE ANNUAL MEETING OF THE AMERICAN ORTHOPEDIC ASSOCIATION AT TORONTO, JUNE 7-10, 1920

BY CLARENCE L. STARR, M. D., COL. C. A. M. C., TORONTO, CANADA

The war is yet too short a distance from us to view in proper perspective the effects it may have on the civilian surgery of the future, but still there are some lessons which we should learn, so that the knowledge attained in the struggle may be made permanent and civilian surgery be to that extent advanced and the public to the same extent be better served.

It is to some of these points that I wish to direct your attention for a brief period this morning. For some time before the war certain features of its work were being forced upon the attention of some of the members of this Association, who were thinking of its future. From a survey of the early history of the Association one is impressed with the energy and skill with which the pioneer members approached their problems and struggled for their solution. The greatest credit is due to these men for the foundations laid for the future of this branch of surgery.

The necessarily chronic nature of the types of cases coming under their purview required a degree of patience and tact which it is difficult for the younger generation in these rapidly moving times to emulate or be willing to follow.

The unwillingness of the modern patient also to consent to be harnessed up for life to a cumbersome apparatus, if by surgical means he could be relieved of this necessity, was a stimulating factor in the search for such surgical relief.

The war, with all its opportunities for study, from a mass of material hitherto unknown, was possibly the last factor in a series

of events which seemed to open up a vision of a field of work previously untouched by our Association, and yet one which our members, properly trained, were pre-eminently fitted to occupy.

In the earlier days of orthopædic surgery, the credit for its greatest strides is largely due to the men of this continent; but for the new vision of the possibilities of our special surgical branch we are indebted to the foresight, and widened horizon of one who is a great friend of this Association, and I am sure we are all united in doing him homage,—I refer to Sir Robert Jones.

The scope of the orthopædic surgeon, must, by general consent, be widened to include all of the surgery of the extremities and spinal column. The first problem which confronts us, if we accept this field of opportunity, is whether we, as individual members of this Association, are prepared to assume the responsibilities of this widened field.

The war work showed unquestionably that in some respects we were falling short of being properly qualified.

If I were asked to state the chief defects we exhibited in thus failing to measure up to the full measure of the opportunities presented, I should say they were, first: an inadequate knowledge of practical anatomy, and second, an insufficient training in the fundamentals of general surgery.

To our credit be it said, we learned rapidly, and to some extent those defects have been remedied. To the general surgeon in the war we are indebted for much that was helpful and stimulating, and in some instances where orthopædic surgeons were not available, the rapid assimilation of our special knowledge by outstanding general surgeons put them in a position to render some of the most valuable service of the war.

If these are real problems, what is the solution? It is unfortunately a fact that the average student comes to graduation in the bulk of our colleges with a very poor working knowledge of anatomy. Is this the fault of the student or the fault of our methods? It may be that both are at fault. The student is not sufficiently impressed in the early years with the value of anatomy in his surgical future and he is apt to look on this subject as a grind, so much work to be plugged for examination purposes.

There is not, possibly, sufficient correlation between his primary and his final work.

The student learns the origin and insertion of a muscle or series of muscles without relating these facts to the leverage involved or the function performed, and consequently he does not get the point of view of the surgeon who has to consider the breaking of the lever in fractures, or the loss of power of the muscle in paralytic conditions.

If the facts of muscle origin and insertion could be visualized in their action pathologically, as well as anatomically, it would add materially to the interest of the primary student in the subject. In the same way if, instead of simply learning that certain nerves supply certain muscles, a necessary but wholly uninteresting fact, a picture of the effect of interrupting the nerve, on the musculature of the limb could be presented, it would at once impress itself on the mind. In this way anatomy could be made to live and take on a wholly new aspect.

The ending of the primary years should not be the end of the anatomical teaching. It is essential that surgical anatomy and surgical pathology should be a part of every surgical clinic. In fact, a proper conception of diagnosis and treatment is almost impossible without it.

To carry this out means, of course, a working knowledge on the part of our clinicians of these subjects. Can we all qualify? It should be the aim of every Medical College to have such a properly trained teaching staff. In such cases as the orthopædic surgeon is called upon to treat, a thorough knowledge of living anatomy is essential. Many a student may know the extremity surgery in the dissecting room where all structures are exposed, but to know what structures are to be met after a certain incision through skin and fascia is made requires a knowledge of anatomy best gained by surgical experience as assistant to a competent surgeon.

The teaching of surgery in the average school of medicine may be equally open to a certain degree of criticism.

To be successful as a teacher of surgery one must have a love of the work sufficient to sacrifice one's own personal interests and monetary gain, as the bulk of schools are at present organized.

The necessity of most of us to earn a living, makes it impossible to devote the time essential to reach the highest point of ef-

ficiency possible. As a rule, with few exceptions, there is not the central control of the head of a department who can devote sufficient time for the proper correlation of all departments.

Whether orthopædic surgery is taught as a sub department of surgery, or as a separate department, is not of much moment, so long as the students get a good foundation. For those who aim at orthopædic surgery a training in general surgery is absolutely necessary. One thus develops the surgical sense or surgical judgment, and he, after such training can more adequately size up his surgical problem, and in terms of function estimate whether his patient is going to be functionally improved, or, if it is an operation for improvement of appearance, whether this will be attained.

At least one year should be spent after graduation, as assistant to a competent general surgeon in a hospital with fairly large clinical facilities. After this a further year or more is essential under the guidance of an orthopædic surgeon; and if a post can be secured as assistant attending, where the counsel and support of a chief may be possible, both in staff conferences and daily personal contact, the training would be complete.

The surgical lessons learned during the war and the subsequent reconstruction period should be made permanent, especially in so far as they affect our special department.

In the treatment of compound fractures invaluable information has been afforded. That we did not adequately handle these cases in the early stages of the war was evidenced by the large mortality from such compound infected fractures as those of the femur. The lessened suffering and decreased mortality in the later stages spoke in thunder tones to those of us who saw both stages. The comfort with which such cases may be transported should result in all civilian ambulances being equipped with Thomas Splints, and similar appliances for the upper extremity. The prevention of infection by debridement should be remembered in treatment of railroad and industrial accidents.

The information obtained during the reconstruction period in the treatment of nerve injuries by suture and nerve transfer, and the reproduction of function by tendon transference in irreparable nerve injuries, with resultant paralyses, should be made available in all suitable civilian injuries.

Our responsibilities as surgeons of the extremities will also be great in other respects. The treatment of simple fractures of bones was not greatly advanced by war experiences and the various controversies and discussions as to a standard or best method of treatment show that the desired end is not yet attained. It is for us to determine and ultimately decide, if we are to take the leading position in the treatment of these conditions, what is the best method of handling these. The fact that we are continually confronted with very serious loss of function, with malunion and non-union in so many of these cases, is evidence of the fact that as a whole the profession does not handle these cases well.

The complaints of these sufferers remind us of the lamentation of King Richard when he claims that he was "deformed—unfinished, sent into this breathing world scarce half made up and that so lamely and unfashionable that dogs bark at me as I halt by them."

To prevent such complaints and to render impossible the numerous litigations arising from such results is one of our problems. The advantages and disadvantages of steel plates and bone plates, of operative and non-operative treatment, of massage and mobilization, are all points to be discussed and order brought out of the chaotic thinking of some of our surgeons.

It should probably only be necessary to teach the principles upon which sound treatment rests to secure good results, and then the judgment of the individual should be left to decide which method will best adapt itself to fulfil these requirements. Proper length, good alignment, with restoration of function in as brief a period as possible should be the general foundation upon which all teaching should be based.

The infections of bone also form one of the problems confronting us. The early diagnosis of acute infections and the proper method of treatment is far from being as satisfactorily handled as one could desire, as evidenced by the great number of cases of extreme destruction of bone seen in any children's clinic.

The method of treatment in these cases in nearly all text-books is surely faulty and may lead to much more serious results than if nature were left unaided. The instruction to chisel into the medullary canal, is found in a great many text-books and is

surely based on a wrong conception of the pathology of these infections.

These and many other problems of extremity surgery might properly form the basis for research work on the part of some of our younger members, which would bring great credit to the individual and help to establish our Association on a more scientific foundation. It is not possible in the short space allotted to such an address as the present, even to designate the many other problems confronting us; but in view of the great prominence given to it in our reconstruction work, one other subject deserves our honest consideration, viz., the place which physio-therapy should occupy in our treatment.

The medical profession is probably responsible for the fact that so many and varied healers have arisen and command a fairly large following even among a class of people who are otherwise intelligent.

The bone setter unquestionably held his position from the fact that the medical profession failed to recognize and bring into use in a legitimate way, that modicum of truth which undoubtedly existed in his practice.

There apparently is not even so large a germ of truth in the various other "pathies" with which we are surrounded and which flourish as in a natural habitat in the Republic to our south. The electro-therapeutist and hydro-therapeutist in our midst, although legally qualified, in most instances, to practice the art of healing, has been willing to work a credulous public in many instances for commercial purposes, and no very great effort has been made to get at the real value in these various methods.

Early in the war, the eau courant baths were introduced for therapeutic purposes, and these were rapidly followed among all the allied nations by elaborate equipment for hydrotherapy, electrotherapy, thermo-therapy, mechano-therapy and massage. To these were added gymnasia and workshops of various sorts for therapeutic and occupational purposes.

Those of us who had the opportunity of four years' of service have had the advantage of watching the effect of these varied agencies in the treatment of medical and surgical conditions from a clinical standpoint.

That the results have not been as good as some of the enthu-

siastic supporters of those methods had hoped, is certain, but that they had, outside of the psychological effect, some beneficial effect is equally certain.

It surely remains for us in these post-bellum days to sit down quietly and make an estimate of these values, separate the wheat from the chaff, and save the grain of truth for future work.

Ample opportunities should be forthcoming from industrial surgical conditions and from convalescent medical conditions to make use of these beneficial agencies. In addition to a canvass of the clinical values a great opportunity is ours, by means of laboratory research, to investigate the scientific values of these "therapies" and put them on a scientific foundation.

In the field of hydrotherapeutics a problem necessary to be solved is whether the entire value is due to heat, whether any virtue, aside from the psychic, is added in the running water, or the forced aerated baths, or whether these factors simply tend to displace that layer of air which apparently exists between the water and the limb and permits of closer application of the heat.

The effect of the heat upon the rapidity of blood flow through the tissues, the depth of penetration of this heat, not only moist heat but other forms of heat, such as dry or radiant heat, diathermy, etc., the transient or lasting character of these effects are all problems for research and solution.

In a similar way, the investigation of the effects of electric currents on normal and pathological tissues, and, in cases of injuries to nerves, the effects on normal denervated muscles.

The effects of ionization with various chemical agencies, on normal and pathological tissue is necessary, to prove whether anything of value can be hoped for from this line of treatment.

Only a suggestion of the various lines of research open to us can be here touched upon, but it is hoped that it will be sufficient to stimulate the interest of our members and that we may hope that the future will see the solution of many of these problems by our interested members.

Already, through a grant given by the Canadian Government through the Department of Militia and Defence, we have a Research Committee, of which your president is Chairman, working at a number of these problems, and some progress has been made toward a solution of some of them. It is hoped that even

after the demobilization of our expeditionary force this Committee may be continued by the Department of Federal Health.

When these therapeutic agencies have been foundationed, from a clinical and experimental standpoint, then the Medical Colleges should undertake to instruct all students of their values and methods of administration. In Hospitals there should exist sufficient equipment to carry out these methods, and there, technicians should be trained who, under the direction of medical men, could administer these forms of treatment so that the suffering public could be assured of the best that could be obtained in these lines, and to the same extent discourage unqualified men from practicing them.

If in addition to this, our legislatures should enact legislation requiring all and sundry chiropractors, osteopaths, Christian scientists, and various other healers to conform to our standard of educational entrance for matriculation, and take the preliminary training demanded by our Medical Colleges before they should be qualified to practice, the difficulty of the unqualified man in the community would be largely solved and the public protected.

Occupational therapeutics for bed-ridden patients undoubtedly plays an important part in keeping up the morale of those who are confined to bed for some considerable time. Basket making, bead work and even fancy needlework can be readily learned even by men, and serve to pass the time.

For the patients who are able to be up and about, however, this form of pastime is not to be recommended, as it tends to lower the morale and leads to hospitalism.

The consensus of opinion among our medical officers is that as soon as possible active exercise and work should be substituted for the passive movements and massage.

The workshops have been an excellent means of getting this type of treatment. The work is primarily therapeutic and if it can be made the starting point for a vocational training course so much the better. The various workshop activities include wood working in all lines, sheet metal and machine shop work, printing, boot making and repairing, draughting, electrical wiring and others.

The encouragement men get by finding out that they are not derelicts but can do in various lines very creditable work, is ex-

ceedingly great, and many a man is rescued from the verge of despair and brought back to an interest in life and citizenship.

The gymnasium similarly is a most useful therapeutic adjunct, and it is easily demonstrated that a short active treatment in gymnastics and organized games does much to assist the return of function. Too much emphasis cannot be placed on this feature of the work, and in the future the active treatment should be made to serve a greater purpose than hitherto.

THE OPEN OPERATION FOR CONGENITAL DISLOCATION OF THE HIP

BY HERBERT P. H. GALLOWAY, M. D., C. M., F. A. C. S.,
WINNIPEG, MANITOBA.

(Read at the Annual Meeting of the American Orthopaedic Association, at Toronto, June 1920.)

It is said that "traditions die hard," and those associated with surgery are no exception to the rule. The tradition that congenital dislocation of the hip should be treated, not by open operation, but by one of the various so-called "bloodless" manipulative methods, continues to manifest an extraordinary degree of vitality, notwithstanding the fact that such methods are blind, irrational and deplorably uncertain in results.

Twenty-five years ago congenital dislocation of the hip was regarded on this continent as practically incurable. In Europe considerable operative work had been done in this field by a handful of pioneers, and in America Phelps and a few others, following the lead of European surgeons, were performing open operations, the chief feature of which was the ruthless scooping out of the shallow acetabulum. The stiff and functionally unsatisfactory limbs which often followed these operations, together with the appreciable danger which attended them, did not appeal strongly to most workers in the orthopaedic field; and even if the results had been much better, the open operation would hardly have become generally popular with the orthopaedic surgeons of that time, most of whom had been trained much more thoroughly in mechanical than in major operative surgery.

Rumors that Lorenz of Vienna had perfected a method of bloodless reduction had crossed the Atlantic, and when this surgeon visited America and gave his seductive demonstrations the keenest interest was aroused, and our orthopaedic specialists set resolutely to work to remove the reproach of incurability which clung to this deformity. As has often happened before, zeal outran judgment, and patients who were too old, or who, because of unfavorable anatomical conditions were unsuitable subjects for the operation, were subjected to the most severe manipulations, often with doubtful benefit and sometimes with disastrous results.

About one year after the visit of Lorenz, the late Dr. H. Augustus Wilson presented to the American Orthopaedic Association at Philadelphia a series of cases treated by manipulation, some of which had been operated upon by Lorenz himself, and others by Wilson and his assistants following the Lorenz method. It is not unfair to state that the average result in these cases was not such as to arouse enthusiasm. Notwithstanding the variable results secured by manipulative reduction since that time, this method continues to be the routine treatment for this disability.

At the eighteenth annual meeting of the American Orthopaedic Association at Atlantic City in June, 1904, Dr. Harry M. Sherman of San Francisco read a remarkable paper in which he advanced what seemed to me an unanswerable line of argument opposing manipulative reduction, and favouring arthrotomy as the routine treatment. Dr. Sherman's paper must be read to be fully appreciated, and I can review only a few of its outstanding features. Disgusted with the downright failures and fictitious successes of the manipulative method, he definitely abandoned it in 1898, and with one exception performed arthrotomy in all subsequent cases up to the time his paper was presented six years later.

Dr. Sherman's line of reasoning cannot be improved upon, and inasmuch as my experience has placed me in complete sympathy with his conclusions, I wish to quote from his paper at some length. He says:

"As regards the manipulative method, I am sure that Lorenz told the whole truth when he stated that the obstacle to reduction was the narrowed part of the capsule at the posterior and superior, or superior part of the acetabular rim. If the opening at this narrowed part is big enough to permit the head to pass, reduction can be accomplished by manipulation, and may be maintained if the acetabulum is deep enough. I have in two instances done this, I know. But in the twenty-eight hips in which I have done arthrotomy, and in which I have explored the narrow part of the capsule by my finger, and so know its size and the strength of its walls, there has been but one case in which the passage of the head would have been possible. I am not too dogmatic when I say that no possible force could have put the femoral head through the narrow part of the capsule in any of the other cases. One possibility and twenty-seven impossibilities!

"Now what happens when attempts are made to accomplish this impossibility? Lorenz has reported plenty of fractures of the femur and one each of the pubis and of the ilium, and other operators have done the same.

(Davis: Am. Jour. Ortho. Surg., Feb., 1904.) Lorenz reports seven cases of paralysis out of 400 odd operations, but Taylor, (Am. Jour. Ortho. Surg., Feb., 1904) looking carefully for the condition, finds 11 cases in less than 50 operations, by various operators, including, I believe, Lorenz himself. While Taylor states that most of these cases recover, the uncertainty of the result is patent to all who have had the misfortune to injure a few major peripheral nerves. It surely is an accident that cannot be disregarded. My own contribution to the casualty list is the report of a case of Lorenz' own, of rupture of the capsule of the hip joint, distal to the constriction, and the thrusting of the femoral head out among the muscles of the thigh. While only one case was shown to have had this accident, still, from the similarity of the clinical conditions, I believe another had it, and it is not in the least impossible or improbable that it occurs in very many cases, especially in the class called 'anterior transposition.' Finally, on all sides one finds the absurdity of the term 'bloodless" pointed out and the reference to the lacerations of the muscles, the extravasations of blood and hematomas. And, last of all Lorenz has reported one case of gangrene of the whole lower extremity.

"These accidents must make anyone who is not an enthusiast, or a special pleader, stop and think. One must say that to justify the exposure to such risks the percentage of successes, anatomic and functional, must be high, so that the benefit may, in the opinion of all, outrank the possible harm.

"What is the percentage of successes?

"From what we have seen of the Lorenz results, scattered between Boston and San Francisco, we cannot believe that he ever really got good anatomic results in about half of all his cases. I am told that Wolff's claim was for only 25 per cent. of anatomic repositions, and Ridlon, in the most recent pronunciamento, claims only 10 per cent. though he hints at 20 per cent. Is this enough?

"One hundred children out of one hundred are exposed to fractured bones, injured nerves, lacerated muscles, torn capsules and ruptured blood-vessels.

"Ten out of one hundred may expect to get the prize sought.

"Sixty out of one hundred may get the doubtfully 'good result' of an anterior transposition.

"Thirty children out of the hundred are perhaps to be considered fortunate if they get nothing.

"In all seriousness I declare that the percentage of successes is not enough to warrant the risk; and personally I claim that the percentage of successes is not enough to justify the method apart from the risk."

Before hearing Dr. Sherman's paper I had carefully tried out various methods of manipulative reduction, at first following the Lorenz technique—as I had seen him practice it—with scrupulous attention to every detail; and later introducing such modifications and improvements as my own experience and that of some of my colleagues of the American Orthopaedic Association had shown to be desirable.

Immediately after my return from Boston, where I had gone to see Lorenz operate, I had a female patient of three years with congenital dislocation of both hips, and a true anatomical reduction was easily effected on both sides; the patient was perfectly cured and remained so. This naturally made me at once an enthusiastic disciple of Lorenz, but unfortunately subsequent experience was far less satisfactory and I can only recall a couple of other cases in my practice where a true anatomical cure was secured by this method.

After hearing Dr. Sherman's paper I began to try out cautiously the open operation in selected cases, and finally, a number of years ago, abandoned the manipulative method altogether. Without attempting to explain the large percentage of cures claimed by some advocates of the manipulative method, I wish to say that my experience abundantly confirms Dr. Sherman's contention regarding the practical impossibility in most cases of passing the head through the constricted portion of the capsule. Very exceptionally, in the youngest patients, this can be accomplished, but in the hips I have opened it was clearly a physical impossibility in at least ninety-five per cent. After making a free opening in the capsule and flexing the thigh, the tip of the index finger can readily find the shallow acetabulum covered in, except a small portion at its upper, or upper and back part, by a wall of capsule. The upper limit of this wall is felt as a well defined border past which only the tip of the index finger will ordinarily go. To anyone who has become familiar with the sensation of "hour-glass" constriction imparted to the finger, the absurdity of attempting to find and pass this minute aperture without opening the hip seems beyond argument. Only after the constriction has been freely relieved by the knife can the head really be placed in the acetabulum.

How is the popularity of the so-called "bloodless" method of reduction to be explained? It must be admitted that manipulative reduction has for more than two decades been the routine treatment of this deformity, and there is little to suggest that the members of the American Orthopædic Association, who treat most of the cases on this continent, are prepared to abandon this method in favour of the cutting operation. In answering this question it is only necessary to bear in mind a few facts. Before the introduction of the manipulative method, congenital dislocation of the

hip was an incurable affection—most cases after being diagnosed, were simply dismissed. To be able actually to cure a small proportion of cases, and to bring about distinct functional improvement by anterior transposition in a very considerable number of others, without resort to the knife, was under these circumstances a rich find. Happiness being relative, the orthopædic surgeon who had discovered a kind of half cure for a condition before which he formerly stood helpless and humiliated, was naturally elated, and the manipulative method was practised with a will and energetic efforts were put forth to improve it; if results were not always ideal, the surgeon at least had the satisfaction of knowing that he had followed orthodox surgical practice and that no one else could show a larger proportion of successes.

Most of us prefer a known to an unknown path, especially in responsible surgical procedures where a false step may be disastrous to the patient; and the manipulative method has been followed so universally that few have gained a large measure of practical acquaintance with the open operation: In a word, the open method has been left almost without either teachers or students. The result is that today to most orthopædic surgeons the open operation remains an uncharted sea full of uncertainties and imaginary dangers.

My own first attempts were made with no little misgiving, but confidence has come as experience has increased; the difficulties to be expected can now be forecasted with reasonable assurance, and the kind of operation most suitable at different ages can be determined in advance with tolerable certainty. In short, my experience has so far crystalized that I now find myself able to lay down certain general rules for my own guidance in the management of these cases as they come to me at all ages from infancy to adult life. These principles I shall endeavor to lay before you.

1. All cases should be treated by open operation, never by manipulation alone. This rule is subject to possible modification, should the claim recently put forth by Henry W. Frauenthal of New York, and published in the Journal of the American Medical Association on January 10th, 1920 be sustained by future experience. Frauenthal claims to have discovered, accidentally, that in children up to two and a half years of age the dislocation can be reduced by manipulation without an anæsthetic, and will re-

main reduced, in nearly all cases, without applying the usual plaster-of-Paris fixation, the child being allowed to go about at once without restriction. This sounds too good to be true, but one must be sufficiently open-minded to await further evidence regarding such an extraordinary claim when put forward seriously.

2. The common teaching that the open operation should be reserved for cases where treatment by manipulation has failed, is in my opinion both wrong and mischievous, notwithstanding the fact that so high an authority as Mr. A. H. Tubby has, in a recent excellent article in the Lancet reiterated this teaching. With the possible exception of the cases suitable for Frauenthal's manipulative reduction without anæsthesia, the open operation should be performed without previously trying the manipulative reduction, or at any rate, only such gentle manipulations as will do no damage to the tissues in the event of failure, should be attempted. If one believes that it is nearly always a physical impossibility to pass the head through the constricted part of the capsule without enlarging the opening with the knife, then it is irrational to damage the tissues by a blind manipulation foredoomed to failure. Especially is this true when attempts at manipulative reduction are carried to such extremes as are described in Mr. Tubby's paper. He says:

> "No matter what the age of the patient may be, no resort is made to open operation until every effort has been made to reduce the dislocation by the manipulative methods. In one instance, no less than eight such unsuccessful attempts were made, and only then was I compelled to devise this new method of operation. Portions of the adductors had been exsected, extension had been tried by heavy weights for several weeks, traction by pulleys up to the danger point had been used; and even when the trochanter major had been pulled down one inch below its normal position we found that flexion, hyper-extension, abduction, circumduction inwards and outwards were all unsuccessful."

Such a statement coming from a surgeon of Mr. Tubby's ability and experience reveals in a striking manner how powerful is the grip with which traditional teaching holds the profession in regard to this particular surgical condition. Such persistent unsuccessful efforts accomplish no good and they do great harm, for scarred and bruised tissues of lessened resisting power to infection do not afford the most inviting field for a subsequent cutting operation, and cannot function as perfectly after the operation as tissues which have not been treated so unkindly.

3. The best age for the open operation is between two and three years. The difficulty of keeping the plaster dressing from being soiled introduces unnecessary complications if one attempts to operate before the child has been taught to indicate when evacuation of the bladder or bowels is desired.

4. For this operation there are two main paths of approach to the hip joint,—the anterior and the posterior. For most children under six the anterior incision affords the best approach to the joint; but in older patients, or in any case where exceptional difficulty is anticipated, the posterior route offers certain advantages. Exceptionally, when the head is high above the acetabulum and unusually difficult to draw down, the posterior route may be used even in young children; vice versa, a very loose hip, in which the head can be brought near the acetabulum by manual traction, may be attacked successfully by the anterior incision at any age. I have been conscious for some time past of an increasing fondness for the anterior route, and since reading Mr. Tubby's paper, (which did not come to my notice until the paper I am now presenting was practically completed), I feel certain that the anterior incision is likely to find more and more favour in my own practice. Mr. Tubby's paper has convinced me that in my own operations sufficient conscious attention has not been paid to the part played by the iliopsoas and that by dealing deliberately with this resisting structure, as described by him, instead of dividing it only incidentally and perhaps imperfectly while relieving the constriction in the capsule, the scope of the anterior approach to the joint may be extended very considerably.

5. In single dislocations there is practically no age limit to treatment by open operation; a stable hip, but one with limited mobility, can always be secured even after full adult life has been reached, though not a true reduction such as is possible at an earlier age. Even in adults with double dislocation, if there is much disability, at least one hip should be stabilized; neither hip should be subjected to operation if the disability is small. The correction of the extreme lordosis which is present in adult patients is in itself well worth while, even if accomplished at the expense of ankylosing one hip, for it delivers the patient from a constant mechanical strain. If but one hip be dislocated the lordosis disappears; but even if the dislocation be double and only one side is submitted to operation, the improvement as regards

lordosis and the increased mechanical security will be much appreciated by the patient.

6. In double dislocations in children both hips should never be operated on at one time; my usual practice is to allow an interval of from six to eight weeks to elapse between the two operations; and if the operation has been unusually difficult, so that there is reason to fear great limitation of movement, it may be well to allow several months, or even a year, to elapse between the two operations so that the ultimate effect of the first operation can be fully estimated.

DESCRIPTION OF THE OPERATION

The Anterior Route: In operating by the anterior incision my technique has followed closely that described by Dr. Sherman, except that the upper part of the incision is extended backwards, and I have never performed a subsequent osteotomy to overcome torsion deformity as recommended by Dr. Sherman in his second paper. An incision about four inches in length is made in the long axis of the limb, beginning just below the anterior superior spine; the upper part of this incision is extended backwards a couple of inches just below the crest of the ilium. After dividing the deep fascia the interval between the tensor fasciae femoris and the rectus femoris is easily found, and these muscles are separated and held aside by retractors. Then the muscular tissues exposed along the front part of the crest of the ilium is divided, (origin of tensor fasciæ femoris and anterior fibres of gluteus minimus), giving a wide exposure of the field of operation. By rotating the limb outward and inward the head can be easily felt and is exposed by incising the capsule in the same direction as the vertical portion of the external incision. Mr. Tubby recommends that the capsule be opened by a crucial incision, and this may possibly have certain advantages. With the thigh slightly flexed, the right index finger thrust into the wound will find the acetabulum and recognize the constricted opening already referred to. A blunt pointed hernia knife, held in the left hand, is then guided cautiously along the palmar surface of the right index finger into the acetabulum above the constriction; the knife is introduced with its flat surface resting against the right index finger, then by rotating the handle with the left hand the edge is

brought into contact with the constriction which is then freely divided in a downward, or downward and slightly backward direction, thus avoiding risk to the femoral vessels. If this part of the operation be well performed, on withdrawing the knife it will be found that the entrance to the acetabulum is now free, and by using deep retractors the acetabulum can often be clearly seen if the light is good. No exact routine manipulation is used to place the head in the socket; the best way to accomplish the desired end will readily suggest itself and in very young children it is accomplished with great ease. Usually the thigh is flexed to a varying degree, and then a combined abducting, rotatory and lifting movment, with or without external pressure on the trochanter, will usually cause the head to slip into the acetabulum without difficulty; the chief requisite in effecting reduction is to have a clear mental picture of the effect of various manipulations on the direction of the head. A gouge chisel, with a blunt rounded edge, introduced into the acetabulum is useful in nearly all cases, in fact in all but the youngest children it is almost essential; not only does it serve as a guide and lever on the same principle as a shoe-horn, but also acts as a retractor and speculum. Ordinarily, after having effected reduction one re-dislocates once or twice so as to test for the position of greatest stability; having ascertained this an assistant is given the responsibility of maintaining the desired position during the closure of the wound and the application of the dressing and plaster. Usually full extension of the thigh, 25° of flexion of the knee, 40° to 60° of abduction, and slight or pronounced internal rotation will meet the requirements. The deep part of the wound is quickly closed with a continuous suture of plain catgut, and the skin with silkworm gut. No attempt is made to effect accurate repair of the capsule; after the head had been placed in the acetabulum the tissues fall together more or less naturally and closure of the deep part of the wound is an easy matter.

The first dressing is usually left undisturbed for a month or six weeks. If thought desirable the stitches can be removed in a week or ten days through a window cut in the plaster. When the second plaster is applied at the end of about six weeks the abduction and internal rotation are diminished, and as the second plaster is not carried below the knee, the child is now encouraged to bear weight on the limb. A third and even fourth dress-

ing may be applied at intervals of a couple of months, the degree of abduction being diminished at each successive dressing.

The Posterior Route: When operating by the posterior route the joint is approached through a Kocher incision from five to eight inches in length, according to the size of the patient. The upper part of the incision extends from the upper border of the trochanter in a direction corresponding roughly to the fibres of the gluteus maximus, and the lower half follows the long axis of the limb along the outer side of the femur. Having divided the fascia and exposed the upper part of the vastus externus and the insertion of the gluteus medius, an incision is then carried to the bone, extending obliquely from the upper angle of the trochanter posteriorly downwards and forwards to its anterior border, following the line of the insertion of the gluteus medius; then, by keeping the knife close to the bone the upper part of the trochanter is quickly denuded of all its muscular attachments. The fibres of the gluteus maximus are easily separated in the line of the upper limb of the skin incision; this exposes the capsule which is then opened along the upper border of the head and neck. It may also be necessary to make a more or less complete circumferential detachment of the capsule from the outer part of the neck.

It will now be easy to locate the acetabulum, which is usually shallow. In older patients it may be necessary to clear it with a curette, or even to deepen it, but such procedures should be avoided as far as possible as it is desirable to keep the cartilaginous lining of the cavity uninjured.

The really difficult part of the operation now begins, viz. reduction of the dislocation. The head is often so high above the acetabulum that reduction seems impossible. Strong traction applied to the limb may fail to diminish the distance appreciably. As the operation by the posterior route is usually reserved for older patients in whom we expect difficulty in effecting reduction, it is usually advisable to do a free tenotomy of the adductors, just before beginning exposure of the hip region, so as to diminish resistance to the descent of the head. It is not necessary to divide either the rectus or the hamstrings, as these are easily relaxed by flexing the thigh and knee.

It has been suggested not only to perform various tenotomies, but also to apply powerful weight traction for several weeks be-

fore doing the operation proper; trial of this preliminary traction has convinced me that it is practically useless and in my own practice it is no longer employed. A "shoe-horn" instrument of suitable width is practically indispensable. After trying various special instruments I have settled down to the use of a heavy carpenter's gouge, the cutting edge of which has been made blunt and the corners rounded. Passing this instrument between the head of the femur and the pelvis, this blunt rounded end is introduced as deeply as possible into the acetabulum. Strong traction is now applied to the limb by assistants who, by rotating the limb as instructed by the operator, cause the head to travel in any desired plane on its journey toward the acetabulum. By pressing strongly on the handle of the "shoe-horn" powerful leverage is applied to the head at the same time that the assistants continue their traction efforts; if need be tremendous force can be exerted, but care must be taken or the head may be badly crushed. After maintaining the effort for a brief period it is sometimes wise to desist for a moment or two and then repeat it, and by persevering it will be found quite frequently that reduction which at first seemed impossible will succeed after several trials. Sometimes, however, especially in older patients, reduction is obviously impossible. Under such circumstances the head and neck should be removed and the trochanter rounded off and an effort made to place it in the acetabulum. This will usually succeed, but in two patients, where the head was riding exceptionally high on the ilium and the resistance was unusually great, I found it necessary to remove not only the head and neck, but also about one inch of the upper extremity of the femur distal to the neck, before it became possible to implant the femur in the acetabulum. This sounds heroic, but the functional result in one case was excellent, (Case 2) in the other, (Case 6) the patient was 36 years old and as the operation was performed only a month ago, the result cannot yet be stated. Such free removal of bone may or may not be required in adult patients; it all depends on the height of the head above the acetabulum and the degree of resistance of the soft tissues. Exceptionally the acetabulum will be found so shallow that it must be deepened, especially at its upper part; I have found a sharp Jones gouge the best instrument for effecting this. Finally, in certain cases in adults it may appear desirable not merely to remove the head and neck

and shorten the trochanter, but also to denude the acetabulum of cartilage, even if it be not particularly shallow, this being done with the deliberate intention of bringing about bony ankylosis in the position of slight abduction. In single dislocations one should not hesitate to adopt such a procedure if reduction by less radical measures prove impossible. As has already been pointed out, such an operation must not be done on both sides in a case of double dislocation; but in properly selected double cases the patient's comfort and activity can be greatly promoted by doing this operation on one side; lordosis is greatly diminished, the patient suffers less pain in the back and gains a sense of comfortable mechanical security through having one strong pillar to take the bulk of the weight in standing.

Formerly, in adult patients where great disability existed, or the adducted position of the thighs formed an obstacle to marriage, I used to excise the head on both sides; but I now prefer, if reduction cannot be accomplished even after removal of the head and neck, to ankylose one side, and if necessary, in order to overcome adduction, to tenotomize the adductors and to remove the head on the opposite side.

Analysis of Results: In order to determine the results of the open operation in my practice, a careful analysis of case records has been made. With only a few exceptions these cases occurred in private practice; therefore it has been comparatively easy to keep in touch with them until final results were known.

These records show that I have opened the hip for congenital dislocation fifty times in thirty-seven patients. Seven of these operations in four patients are excluded from the final analysis because they were adults in whom nothing was attempted except removal of the head. As already intimated I have practically abandoned this operation. Three other operations were secondary attempts on hips I had opened before and which had become redislocated. These also will be excluded from the final summing up. Two other very recent cases are excluded because the result cannot yet be known.

This leaves a total of thirty-eight operations in thirty-one patients. The number is considerably smaller than I supposed when the preparation of this paper was decided upon, as I found on going through the records an unexpectedly large proportion

of cases where operation had been advised but refused. There were also a number of older patients whom I advised against any operation because at the time they consulted me my limited experience made me unwilling to accept the responsibility. In many of these, operation would now be undertaken without hesitation.

In attempting to present with perfect fairness the results of these thirty-eight operations, some unexpected difficulties were encountered. In such a matter it is not easy to exclude altogether the element of personal bias. Moreover, the interpretation of results in this class of cases is not as simple as it might seem, and independent observers might not be in perfect agreement in regard to the interpretation.

It was finally decided that the only reasonable plan of presentation was to classify all cases under four broad headings, and then make such qualifying comments as might seem necessary to a clear understanding. Following this plan the classification stands thus:

Cured, 12; good results, 14; failures, 6; doubtful, 6; total, 38.

In nearly all of the cases classified as "cured" the functional results were so good that in unilateral cases one hip was practically indistinguishable from the other. In a small proportion there remained a limitation of movement so slight as to be of no consequence, or perhaps an unimportant imperfection of gait that only critical observation could detect.

In the cases classified as "good results" there was wide variation in the anatomical conditions existing subsequent to operation. For example, in one bi-lateral case the X-Ray shows that the head is not in the acetabulum on either side, yet, beyond an appearance of increased breadth of the pelvis and a very slight roll in the gait which becomes less noticeable as the child grows older, there is little to suggest abnormality; abnormal lordosis has completely disappeared and stability is all that could be desired. In several of the cases under this heading there is marked limitation of movement, and in a few complete ankylosis. In two the radiograph shows the head apparently resting on the edge of the acetabulum; the relation looks precarious but there is perfect stability, and observation and radiographs continued over many months show no tendency for the femur to become displaced up-

wards. In every case classified as a "good result" the lordosis has been corrected and stability of the hip greatly improved; there is no doubt whatever as to the patient's condition being more satisfactory than before the operation.

Of the six operations classified under the heading "failures" one was in a child of four with double dislocation in whom, on both sides, the acetabulum was found so shallow that it was known before the operation was finished failure must result. This child was neither better nor worse. One patient, a boy of eight years, developed severe typhoid fever shortly after the operation, and it became necessary to remove the plaster dressing; the final condition of this patient's hip was rather worse than before the operation. In one patient, (Case 1), the operation resulted fatally under circumstances so unusual that I felt justified in concluding that the fatal outcome could not fairly be attributed to any defect in the operator's technique.

In the six cases classified under the heading "doubtful" sufficient time has not elapsed since operation to determine definitely the ultimate outcome; as far as I can forecast the future there will be in this group:—4 cures, 1 good result and 1 failure.

I feel it only reasonable to suggest that as a result of the experience already gained, future cases will show a larger percentage of cures than that now reported.

Wound Infection: In the fifty operations infection occurred six times; one of these was in the group of seven adults, in whom the head was removed on one or both sides and which are excluded from the final analysis. In this case everything went well for over two weeks, when the temperature became elevated and finally suppuration occurred on one side. This was attributed to chromic catgut; the ultimate result was just as good in this hip as on the other side which remained free from infection.

One case of infection occurred in the second operation, in the group of three hips operated on a second time because re-dislocation had occurred. The ultimate result in this case was such excellent function that the case is classed with the "good results," (Case 5).

This leaves four cases of infection in the thirty-six operations covered by the final analysis. In one of these, (Case 1.) the operation resulted fatally. In another, (Case 6.) the circum-

stances attending the case were peculiarly unfortunate, and the final condition of the patient was rather worse than before the operation.

Two other infections resulted in stiff hips, but in both of these the functional result was excellent.

REPORTS OF CASES

A complete table of all the cases operated upon would involve much useless and tiresome repetition; but a brief report of some of the more difficult and unusual cases may not be entirely without interest.

Case 1. This was the only fatal case in my series. E. M. N. age 6 yrs. 7 mos. female. Congenital dislocation of left hip. X-Ray showed an exceedingly shallow acetabulum and a deformed head. The parents were warned that the prospects for a successful reduction by the ordinary procedure were not promising, and they were willing to have the hip made stiff if this was unavoidable. The acetabulum was found to be very shallow and was deepened at its upper part; the dislocation was then reduced; the cartilage on the head of the femur was not disturbed; the usual dressing in plaster in the abducted position. On the following day the child developed a temperature of over 104 degrees, and in less than four days was dead of acute streptococcus poisoning. Upon investigation it was ascertained that in the same hospital three other cases of acute streptococcus infection had occurred within a week, only one patient surviving. The four operations were all different in character and were performed by different surgeons, all of whom were thoroughly competent men whose practice was limited to surgery. It was ascertained that one of the operating room nurses had a septic throat. No similar cases had occurred in this hospital for a long period before this fatal outbreak. I think it will be generally agreed that in this instance the fatal result was beyond my control.

Case 2. G. F. female, age 10 yrs. 10 mos. congenital dislocation of both hips. The hips were very high and did not yield under manual traction. The lordosis was extreme. It was decided to operate on one hip and observe the effect. Operation October 9th, 1919, Kocher incision as already described. It was found impossible to get the head into the acetabulum. The head and neck were removed and another effort made, but we were unable to get the

trochanter into the acetabulum. About one inch and a quarter of the great trochanter was cut away before it was possible to get the upper end of the femur into the socket. The limb was dressed in plaster in wide abduction. It was not disturbed for four weeks. When the plaster was taken off the joint was tender and any movement of the limb caused much discomfort. The child remained quietly in bed for a couple of weeks, but as neither tenderness nor abduction diminished to any large extent an anaesthetic was administered and the limb brought down parallel with its fellow and plaster again applied for three weeks. After removal of this dressing the patient was encouraged to move about, but for several weeks every movement was carefully guarded and she put weight on the limb very unwillingly. Gradual improvement occurred and the child left the hospital about the middle of February 1920. She was brought to my office for examination on March 1st, when the condition was found much more favorable than could reasonably have been expected. Lordosis was greatly diminished, there was a fair amount of movement at the hip and the limb that had been operated upon was almost two inches longer than its fellow, most of this lengthening being due to abduction. A cork-soled boot was provided for the other foot; when seen two weeks later she was becoming more and more active. Unrestricted functional use for several months will be allowed before deciding whether or not to operate on the other side.

Case 3. V. J. 11 yrs. female, congenital dislocation of right hip. Early in life received treatment by the "bloodless" method from a Chicago specialist. The shortening was more than usual. On the affected side the patient walked on the toes and latterly the lameness had increased. X-Ray showed an imperfect new acetabulum being developed above the old one. Operation September 28th, 1918, Kocher incision. The hip reduced with difficulty. The first plaster was removed December 18th and X-Ray picture taken which showed the head resting on the edge of the acetabulum. There was a fair amount of movement, but the limb was rotated externally and the knee could not be fully extended, the angle being about 150 degrees. The calf of the leg was slightly tender and numb, and remained in this condition for nearly a month, evidently the result of a slight traumatic neuritis; no motor paralysis was present. On December 20th, under anaesthesia, the limb was carefully manipulated so as to rotate it inward, and extend the knee.

A plaster spica was applied extending to the foot. The plaster was removed February 7th, 1919; patient was then given full freedom. Massage and gymnastic treatment commenced and continued for six weeks. Function improved progressively; the hip remained stable; shortening was entirely overcome. While movement was greatly restricted the improvement in her condition was so pronounced that both the patient and her friends were exceedingly well pleased.

Case 4. L. R. 6 yrs. female. Congenital dislocation of both hips with marked lordosis. X-Ray showed the acetabulum shallow and head poorly developed. Operation on right hip November 17th, 1917, anterior incision. Reduction effected with considerable difficulty. December 18th, 1917, plaster removed and X-Ray picture taken. This showed the head resting near the outer edge of the acetabulum. Plaster re-applied with limb well abducted. On March 5th, 1918 plaster removed and stereoscopic X-Ray picture taken which showed that re-dislocation had occurred, the head being above the acetabulum. A further operation was decided upon and was carried out on March 22nd, the hip being exposed through a Kocher incision. Reduction easily effected. Wound closed without drainage and the limb put up in plaster widely abducted. On April 8th plaster in neighborhood of wound trimmed away so as to permit removal of stitches. June 18th plaster removed and X-Ray picture taken. This showed the head in the acetabulum but it was not deeply embedded. Plaster re-applied with the limb moderately abducted and the child was encouraged to use the limb freely. September 24th plaster finally removed and the child given full liberty. X-Ray picture showed the head atrophied and in contact with the outer part of the acetabulum; limb stable and one inch longer than its fellow. Boot with thickened sole ordered for the other foot. February 8th, 1919, again examined and X-Ray picture taken. The relation of the femur to acetabulum had undergone very little change; the head seemed to be resting precariously near the edge of the acetabulum, but clinically it was secure and no slipping occurred under weight bearing. Movement was greatly restricted. The question of operating on the other hip now came up for consideration. It was felt that this involved considerable responsibility in case the second hip should become ankylosed or show greatly limited movement after operation, for of course two stiff hips would leave the child in a condition worse than the original one. It was finally decided that even if the second hip became

ankylosed the difficulty could be overcome by removing the head and neck of the bone. February 11, 1919. Operation on left hip today. Kocher incision. Head manipulated into acetabulum with considerable difficulty. February 28, 1919. Stitches removed without disturbing the main part of the plaster dressing. March 11, 1919: Plaster cut off to above the knee and patient encouraged to walk. March 28, 1919: Plaster removed. X-Ray showed head in acetabulum. Short plaster spica applied. June 4, 1919: Plaster finally removed and patient allowed full liberty. Treatment by radiant heat, massage and gentle manipulation was commenced. After three weeks hip was still very stiff, but patient was allowed to go home for three months. October 8, 1919: Condition greatly improved. Left hip (the second one operated upon) can be abducted and adducted appreciably. Flexion is limited to a few degrees. The femur does not slip upward under weight bearing. October 9, 1919: Anaesthetic administered. Without using any force the right hip moved much more freely than when patient was conscious, showing that the limitation of movement in this hip was due in part to muscular spasm. With the use of very little force it was easily flexed to a right angle, and in performing this manipulation some adhesions, not at all dense in character, could be felt giving way. Two days later the child was walking freely and seemed to have no discomfort as a result of the manipulation. October 15, 1919: Anaesthetic again administered, and the right limb was again moved freely; after which the child was allowed to return home with instructions to report in six months for further examination. It was thought better to postpone any attempts to increase the range of movement of the left hip by forcible manipulation until all possible improvement under ordinary functional use had first been secured.

Case 5. M. M., 13 years, 11 months, female. This patient was a stout well-developed girl with congenital dislocation of right hip. The actual shortening was only two inches, but practical shortening, due to adduction, four inches. The patient and her mother were informed that a stiff hip would probably result from the operation, but the lameness was so pronounced that they were both very willing to have anything done that gave a reasonable hope of improvement. Operation August 25, 1919, Kocher incision. Reduction effected with considerable difficulty. About ten days later patient thought she felt something slip out of place, and on remov-

ing the plaster and taking an X-Ray on September 11th the hip was found re-dislocated. I determined upon arthrodesis as the only sure way of overcoming the shortening and adduction. This was done on September 18th the head being placed in the acetabulum after removal of cartilage from both head and socket. Some infection of the wound occurred which delayed final healing but did no harm otherwise. In two months the patient was walking on crutches; these were discarded entirely two weeks later but a short plaster spica was kept on for four and a half months. At this time the hip was soundly ankylosed in a position of slight abduction and was painless. On March 15, 1920, her mother wrote saying that she was walking well with hardly a noticeable limp, and the patient herself and all of her friends were delighted with her improved condition. In this case I think a blunder was made in not including both thighs in the first plaster dressing. The patient was short and stout, and a single spica was not sufficient to maintain the requisite degree of abduction; I believe that this was responsible for the dislocation recurring after the first operation. By correcting this fault at the second operation reduction might have remained stable without deliberately seeking to bring about ankylosis by removal of the cartilage; but I was disinclined to take any chance of recurrence of the dislocation in connection with the second operation.

Case 5. G. W. 13 yrs. 11 mos. female. Congenital dislocation of left hip. Operation January 3rd, 1920, Kocher incision. The acetabulum found so triangular in shape that it was thought best to excavate its upper part with a gouge. The head was levered into position with very great difficulty after tenotomy of the adductor longus tendon. This girl was short and fairly fleshy. Bearing in mind my experience in Case 4, both thighs were included in the plaster dressing in a position of wide abduction. January 25th, 1920, plaster removed and re-applied as far as the knee, this being done on the affected side only. Hip was found in good condition and freely movable. Unfortunately considerable paralysis of both thigh and calf was found present, due to stretching of the nerves. Patient went home seven weeks after the operation and was told to move about as freely as possible, bearing weight on the limb and steadying herself with crutches, if necessary. This is the only case in my series where the operation produced any motor paralysis.

Case 6. A. K. 8 yrs. Congenital dislocation of right hip. In this case the operation was divided into two stages. At the first operation the adductors were freely divided after which powerful weight extension was applied for several weeks. On March 4th, 1918 the dislocation was reduced through an anterior incision. Reduction was difficult and considerable shock followed. Shortly after the operation he developed a severe attack of typhoid fever, and it became necessary to remove the plaster which allowed the dislocation to recur. He recovered after a tedious illness but the condition of his hip was rather worse than before operation.

Case 7. Mrs. J. 36 yrs. married. Congenital dislocation of left hip, with much shortening and lordosis. The patient was suffering increasing discomfort from backache. Operation May 7th, 1920. Kocher incision. Notwithstanding complete stripping of muscles from the trochanter, free separation of the capsule and complete division of the ilio-psoas, reduction was impossible. The head and neck were then removed, but still reduction could not be effected. Finally, one inch of the trochanter was removed and the upper and back part of the acetabulum slightly enlarged, after which reduction was comparatively easy, and remained stable with the limb moderately abducted. Both thighs were included in the plaster. No bad symptoms followed. The first plaster dressing is still in place and it is too early to speak of the result. Ankylosis with sufficient abduction to equalize the length of the limbs is expected.

Discussion

Dr. John Ridlon of Chicago: I have had a communication from Dr. Sherman with an X-ray of a case that he and I had and presented at the A. M. A. in San Francisco. I will read his letter for five minutes, and then take five minutes to discuss Dr. Galloway's paper, and five minutes for Dr. Adams' paper.

Letter From Harry M. Sherman, M. D., San Francisco, to Dr. John Ridlon

May 24th, 1920.

Once some six years ago, when I, in Chicago, saw you reduce the two hips of a congenital hip dislocation in a child, I asked you if you knew just where you put the femoral head, and you replied that you did not. Then I suggested that if it should be possible for us to be associated in a case, it would be good for you to make the reduction and for me then to make an incision and verify the new location of the head. This chanced to become possible, when you were good enough to come all the way to San Francisco to join me in an operation on a child whom I had at that time in the Chil-

dren's Hospital. The patient was a little girl about four years old, with a bi-lateral dislocation. Your comment on the condition as it was presented was this:

DOCTOR RIDLON'S COMMENT

"Examination made on patient shows both hips dislocated backwards and upwards. The femoral heads cannot be felt in front on outward rotation.

X-ray shows right hip dislocated upward two and one-eighth inches; the left one two and a quarter. The right socket seems better than the left.

OPERATION BY DR. RIDLON

Patient anaesthetized, the right hip is fully flexed; thigh rotated somewhat inwards and then abducted; the femoral head passed into the socket after a minute or a minute and a half's effort. Socket felt very secure, and the replacement was secure and remained without being held.

Then I went to the left hip; replaced the hip with less difficulty and in less time than the right hip. The replacement was secure without being held, but the socket did not feel as perfect as the one on the right side. Both hips were put up by Dr. McChesney in plaster, the right one abducted with the outer side of the thigh posterior. The plaster was carried in both instances down on to the feet.

OPINION: Dr. Ridlon believes that both hips will give a perfect anatomical result.

DR. SHERMAN'S COMMENT

It was very evident from the position of the femoral head, directly under the femoral artery, that Dr. Ridlon had put the head into its proper location. With its reduction, all the tissues—muscular, vascular, fibrous and so on—passing from the pelvis to the femur, were tense, and with this tension on all sides of the femur it was kept as if by stays in the position in which Dr. Ridlon had left it. Under these circumstances, it would be quite impossible for me to make an incision which would permit the occular demonstration of the relation between the head and the acetabulum. After some hesitation, however, I made my usual incision between the long head of the rectus and the tensor vaginae femoris, and could then very easily pass my finger under the rectus and palpate the rim of the acetabulum and the femoral head. They could both be touched by the finger at the same time, the tip of the pulp of the finger being on the femoral head, and the middle of the pulp of the finger lying across the rim of the acetabulum. This palpation demonstrated the fact of the reposition. The question as to whether there was a folding-in of the capsule beneath the head, so that a double layer of capsule was between the cartilage of the head and that of the acetabulum was still, to a certain extent, an open one, and could be settled only by exploring the interior of the articulation. Therefore Dr. Ridlon re-luxated the head, bringing it to its usual dislocated position, and right underneath my incision. I made a cut partially through the capsule and then, having been up to this time, working on the wrong side of the table, I came round the table and cut definitely through the capsule in the proper way, and exposed the head.

When the hip was now flexed, relaxing the anterior portion of the capsule, it was very easy to pass the long blunt-pointed knife, and after it my finger, into the acetabulum, and practically no cutting was required to make way for the finger. Therefore it seemed that the opening in the capsule had been originally large enough for the head to pass

through, or that the opening had been enlarged by the head on its way to the acetabulum; and the former of these was the more likely, because when I opened the capsule there was no blood inside the joint.

With the conditions thus, it was not at all difficult to put the head again into the acetabulum, and the wound was closed and the limb dressed in the way common in these cases, well rotated-in and abducted 90 degrees.

There remains the question of the twist of the femur which exists in this child so that when the toes point forward the femoral heads look very much more forwards than inwards, so that the heads could only be expected to stay in the acetabulum if the toes were kept pointing inwards or a sub-trochanteric osteotomy were done, which would let the heads point inwards as the toes point forwards. That will be done on the right femur at the proper time."

The post-operative history of the child was no extraordinary one. At the end of three months I took the splints off to do the osteotomies which I had considered would be necessary, and at that time the right hip, in which both you and I were interested slipped out of place and I re-reduced it and put both hips back in splints in the original positions—yours in the Lorenz; mine in the Lange position. A month later I let the child go home, and she came to me now and again to have her plaster of Paris changed. In January, 1916, I sent you a photograph of the child, showing the limbs in the original positions—left, Lorenz; right, Lange. In May, 1916, in changing the splints I found a sub-luxation of the left head forward and upward, and it jumped backwards into the acetabulum as I flexed and adducted the thigh. This manipulation was in accordance with your request of February fifth.

My next memorandum of the child was on October 18th, 1916, when both hips were recorded as in place, the right a little deeper in the acetabulum; that the child was walking well, though with somewhat of a waddle.

In February, 1918, stable reduction and improvement in the use of the limbs is noted, and now in May, 1920, I see the child again and note normal use of the hips, and I am sending you the radiograms, showing that reduction in each instance is stable.

My comment on this would be that if everybody could reduce congenital dislocations as you have done it in this case, reduction through an incision would be unnecessary. In those cases where manipulative reduction is not accomplished or is impossible, the operation through an incision becomes of necessity the operation of choice.

You once told me that about 20% of your reduced hips became re-luxated. My experience shows that this re-luxation occurs because of a twist in the upper part of the shaft which swings the head and neck forward, so that they point forward when the toes point forward, and that they re-luxate because of this anterior twist. Therefore I think that the osteotomy which I have been doing and which untwists the twist and gives the head and neck the proper direction of inward and a little forward when the toes point forward, is something which should be done.

I am sending you this report and these comments, and at the same time

some radiograms showing the present condition of the hips. I had the child brought to me from Sacramento so as to have these radiograms and see her.

There having been a number of members of the Association at the Children's Hospital the morning that we did this piece of work, I wanted to report to them the success of your manipulative reduction. I did not, you may have noted in the memoranda, find it necessary to do the osteotomy in the case of this child. It was primarily a posterior location of the heads, and those cases do not as commonly require the osteotomy as do those which have the heads in anterior luxation from the beginning.

I am exceedingly sorry that I shall not be able to be in Toronto, but I shall hope to come East some time next summer and, if I possibly can, attend the meeting of the Orthopedic Association. It would be a very gracious thing if that meeting were put near that of the American Medical Association, so that those of us who have to come a long distance can attend both meetings on one trip." Signed: HARRY M. SHERMAN.

DR. JOHN RIDLON of Chicago: I will talk first about Dr. Galloway's paper as that interests me more. He says that he considers bloodless reduction as a blind, irrational and unsurgical procedure, uncertain in result. I don't suppose that Dr. Galloway knows that his teaching is pernicious. He spoke of Dr. Lorenz coming here and getting us all interested. When Lorenz came here to operate I had operated on 32 hips and I knew how to put on plaster casts. In quoting "the latest pronunciemento from Ridlon" with 10 per cent good results I would say that that quotation was made by Sherman in 1898. As regards fractures occurring by bloodless manipulation, I fractured 5 myself between 1902 and 1904, and have had none since. My statistics were published by the Academy of Medicine in 1904, I have done a lot of work since then. I followed up Lorenz' cases done in Chicago and he had two perfect results. As to Frauenthal, I have not seen his work. Some years ago the New York Orthopaedic Hospital out of 4000 out-patients had 40 congenital hips. For the same year I operated on 41 hips in my private practice, I think I have had about 40 cases a year for 20 years. That experience counts for more than 31 operations. So much for Dr. Galloway's paper. In regard to Dr. Adams,—I have never had any cases of paralysis. As to anterior dislocation, I don't believe many of you know when you have anterior dislocation and when you don't, because I don't believe you know how to tell the relation of the head of the femur to the acetabulum. Most of you are satisfied to judge by the X-Ray. If the X-Ray shows the head away from the acetabulum, it is away, but if the X-Ray shows in, it may be just in front, and unless you know how to feel where the head is you don't know where it is. In some cases that haven't walked the head appears to be in the acetabulum. In cases of multiple congenital malformation the head of the femur is turned forward and lies in front. Heads are not so abnormal as the sockets. The socket always retains some abnormality even if the functional results are perfect. I had a case, a young woman of 20 years of age. I operated on her when she was 11 years old. At 20 you could not tell which hip had been operated upon. She had perfect normal function. The X-Ray showed an abnormal socket and head. As to torsion of the neck, I don't think any of you know anything about torsion of the neck, because you assume

that the head lies always in the same direction. If the dislocation is forward, the head must be twisted forward; if directly upwards, it is not twisted at all, unless upwards; if the dislocation is backwards, the head must be twisted backwards. Heads are not all twisted forward. The time to operate is when the shortening is from 1 to 1¼ inches. If the dislocation is ½ an inch you should not operate. If the child is strong you should not operate on a 2 inch dislocation. I had one case in Indiana, 10 years old. I worked an hour on a 2¼ inch dislocation, then I put in easily the other 2½ inch hip, the child finally walked without a limp, but with limited motion. In one case I did a 3¼ inch displacement for $500 as I needed the money at the time, but if it came now I would not try to do it for a million. As to Dr. Muller, the assistant of Lorenz, it has been the custom to erase any mention of him from the records of this society. Lange originated that position and Muller took the credit. We must know the reason for putting the plaster below the knee. It must be put on to prevent the leg from rotating outwards. But if the plaster is put on below the knee the child can't walk, and unless the child walks the head is likely to slip out when the plaster is removed, if you put plaster below the knee it must be cut after two months so that the child can walk. The reason you have so few good cases is because you keep the child in bed, unless the child walks the acetabulum cannot be deepened.

DR. WALTER G. STERN, Cleveland, Ohio. I am one of those who worked with Lorenz shortly after he definitely abandoned the open operation after performing it 250 times. The open operation was also abandoned by Hofia, who had an experience of over 700 cases. The open operation was not abandoned without good reason by both of these authorities. They at least found the closed method not to be blind, irrational or unsurgical.

Lorenz' results in America in 1903 certainly should not be taken as a criterion of the efficacy of the closed operation: as you know, in the majority of places he worked under the most unfavorable conditions. For instance, in Philadelphia there was a great crowd in the operating room and doors and window sills crowded with physicians; the anesthetist in one case broke the chloroform bottle and had to fight his way out thru the crowd to procure a fresh supply of the anesthetic. Meanwhile the child was kicking and screaming on the table and Lorenz was trying to hold the replaced hip in its socket before putting on the cast. Another one of the Philadelphia cases left Philadelphia immediately after the cast was applied, and was not seen or heard from for another year. In Chicago people fell before him on their knees and begged him to operate on cases whether suitable or not. In the west he was met in the morning by a reception committee, taken to a hospital where he held a clinic, afterwards wined and dined for the rest of the day and then put on a train for his journey to the next town where the same thing was gone thru; and he never saw or heard of these cases again and certainly in the majority of cases the after care was not in the hands of those able to give the best care and attention necessary. I do not believe Lorenz or the method are clearly to blame for the bad results quoted in the paper.

Function and anatomical reposition do not go hand in hand and it is function that must be the measure of success and not the X-ray plates.

A number of years ago I tabulated the results in some 1500 bloodless operations, and found perfect function in 74 per cent of the cases; good in 13 and failure in 13. The statistics were not divided into uni-lateral and bilateral, and a bilateral case was considered a failure if both hips did not function properly.

The operative limits cannot be laid down in terms of years of life, but in terms of strength and resistance of the muscles about the hip. Dr. Jaeger will remember when he and I both assisted Lorenz in reducing the hip of a 26 year old Roumanian girl, which operation turned out to be a perfect functional success. My own oldest case was done when the girl was 13 years old, and we certainly have no cause to regret the results from this operation.

I do not believe that either Dr. Galloway or Dr. Sherman are justified in their deductions that since they usually find a constricted portion in the capsule of the joint, that the bloodless operation cannot succeed in placing the head into the acetabulum. One who knew nothing of the art of obstetrics might say, in finding the cervix undilated that the fetal head cannot get thru because the cervix was narrow and the head large. Practical experience has taught that the cervix will dilate, and likewise practical experience has taught those doing the bloodless operations who have had knowledge of the art of the open operations, that the bloodless operation was by far the most successful, not the few cases from one locality, but in the large majority of all cases the world over.

DR. ALBERT FREIBERG: I would like to speak on one or two points. It surely requires courage on the part of both speakers to have presented papers that differ from the views of orthopaedic surgeons all over the country, and with results so unfavorable as those of Dr. Adams. In the case of Dr. Galloway, the question is not whether he gets the head into the acetabulum, but whether he gets good final results. My experience has been that of Dr. Soutter. I want to consider secondary deformity and limited function after the head has been replaced. This has been emphasized by Legg in his mechanical theory of the so called Perthes or Legg disease. My own view is that this lesion is an infectious process. If traumatic, as in some cases, it should be the uniform sequel of manipulation where the force is considerable. When infection happens it probably does so because the child has infectious foci somewhere else in the body. In my cases to be operated upon bloodlessly (and they will continue to have that operation) I shall continue to have removed diseased tonsils or teeth where found before hand. I have not done that long enough to say whether I shall succeed in preventing subsequent deformity.

DR. JOHN L. PORTER: The trouble with many speakers is that, as in religion, they want to stick to their own dogma, and there is no middle ground where they can meet and come to some agreement. I don't believe that every dislocation of the hip can be reduced by bloodless operation, or that everyone needs open operation. We have considerable disagreement as to how we should treat these cases. There are good grounds for disagreement. I think it is clear that it is necessary to get together a committee to work out the statistical facts just as we had a committee to settle the scoliosis question. It results in considerable advantage. I think when we have operative procedure backed up by a man like Galloway, we should consider his views. I reduced a case in a girl 15 years old, very easily, in 5 minutes.

DR. FREIBERG: What was the end result?

DR. PORTER: That is just what I am going to tell you; it was very bad. The limit of motion got less and less and the hip is nearly stiff. This entire matter should be thoroughly investigated. Something more should be done than to let Galloway read this paper and let another man get up and say Galloway does not know what he is talking about. That does not get any practical result.

DR. GEO. B. PACKARD: About three years ago I reported sixty cases of congenital dislocation. The results in the single cases showed 85% very satisfactory. In the double cases there were more anterior transpositions but these were quite satisfactory. I had a few cases of paralysis which were due to the high position of the head—about 2 inches above the acetabulum. I can see no reason why paralysis would not occur in such cases in the open operation.

DR. GALLOWAY, closing: If I may judge by the trend of the discussion, my conclusions are not unanimously approved. I have only two or three things to say. I think Dr. Sherman was correct when he said that if all cases of congenital dislocation could be reduced as successfully as the case of his treated by Dr. Ridlon, they should be so treated; but I don't think such results are the rule. I am sure that Dr. Ridlon knows more about bloodless reduction than I do; no one in America has had more successful experience than he has had. I have had a few successful, but may unsuccessful cases. If some of the things that I have said will lead to a more favorable consideration of the open operation I shall be well satisfied. It is generally agreed that the bloodless operation becomes more uncertain of result, the older the patient, but many of the older cases can be greatly benefited by open operation. In regard to torsion of the neck,—Dr. Ridlon's statement is purely theoretical. In operating I have always seen a forward twist, but never backward. I can't agree that the results of Lorenz in this country were not a criterion; if he operated on unsuitable cases, he was at fault. His results should be taken as more or less representative.

THE VARIATIONS IN THE ANATOMIC STRUCTURE OF THE LUMBAR SPINE

BY JOEL E. GOLDTHWAIT, M. D., BOSTON

The following communication is made for the purpose of emphasizing the variations in the structure of the lumbar spine, and the importance of the study of this region with reference to such variations, for the explanation of the symptoms of many of the cases of back ache or leg pains.

The communication consists almost wholly of illustrations made from X-Ray negatives which are offered as the basis of study of other cases. The history of the patients from whom the negatives were made is not given in detail, but it should be remembered that all of these patients sought treatment for the relief of pains in the back or in the legs. In the illustrations not only is the low lumbar region shown, about which considerable has been written in connection with back pains, but the dorso-lumbar region as well. The reason for this is that the many patients suffering from pain in the low back, not due to disease conditions, refer the pain commonly to two regions; one being the very low back covering the lumbo-sacral and the sacro-iliac joints, and the other being the dorso-lumbar juncture over the areas that would be represented by the end of the transverse processes of the first lumbar. The anatomic study has usually indicated the reason for the pain, and while the peculiarities in structure and mechanics in the lumbo-sacral region have been discussed more or less of late, very little attention has been given to the conditions as they exist at the dorso-lumbar region. In this latter location the pain is often a dull and heavy ache, but at times is exceedingly acute. with the body listed to one side and held very rigidly by muscular spasm. From the location of the pain it is often supposed to be due to some disturbance of the kidney, but is commonly relieved, at times instantaneously, by manipulation that would relieve pressure of the last rib against the tip of the transverse process of the first lumbar vertebra. At times the rib apparently gets caught behind this process with intense pain due to the direct pressure of the intercostal nerve or to the irritation of the ganglia that lie in front of these ribs. The fact that the rib can get into a position behind the transverse process of the vertebra below is easily

FIGURE 1

In size and general shape of the bodies of the lumbar vertebrae, the shape and size of the sacrum as well as the position of the sacrum with reference to the crests of the ilia and the size and shape of the lower ribs, the above illustration is practically in keeping with the text book normal. The transverse processes are somewhat longer than is supposed to be normal, especially as they appear upon the third lumbar vertebra. There is distinct over-riding of the spinous processes of the 3rd, 4th and 5th vertebrae, which is undoubtedly responsible at least in part for the rotation of the spine here present. The downward inclination of the last ribs, together with the long transverse processes, would make it very easy with the patient in the upright position for the intercostal nerve of the last rib to be caught upon or press against the transverse process.

FIGURE 2

The first four lumbar vertebrae are of the text book normal, and the transverse processes are of the so-called normal length. The last lumbar vertebra in the above illustration shows a distinct articulation upon the left between the large broadly formed transverse process and the top of the sacrum. This shows a large process upon the right side, but with distinct space between the sacrum and the process, in which on the basis of a large number of dissections, undoubtedly a bursa lies, the irritation of which is many times responsible for the pain present in these cases. The bifid condition of the spine at the last lumbar is clearly shown. The case also shows the rudimentary last rib with a somewhat different inclination than is shown in some of the other illustrations.

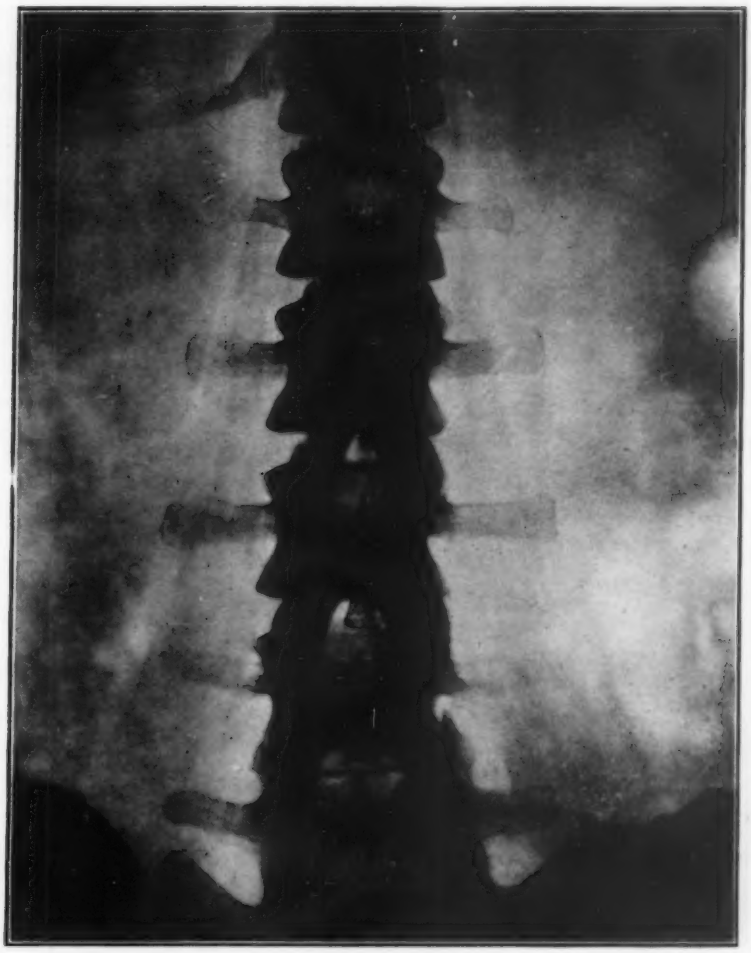

FIGURE 3

A spine of the slender anatomic type, showing the narrow lateral width of the vertebrae, with the greater proportionate thickness measured in the long axis of the body. The length of the loin is to be explained in this way. The transverse processes are long and slender with the rudimentary 12th rib showing with more marked formation upon the left side than upon the right. The ribs as a whole are of the slender type, with the narrow neck close to the head of the rib near the spine. The crescentic articulations with the vertical axes are clearly shown in the four upper lumbar vertebrae.

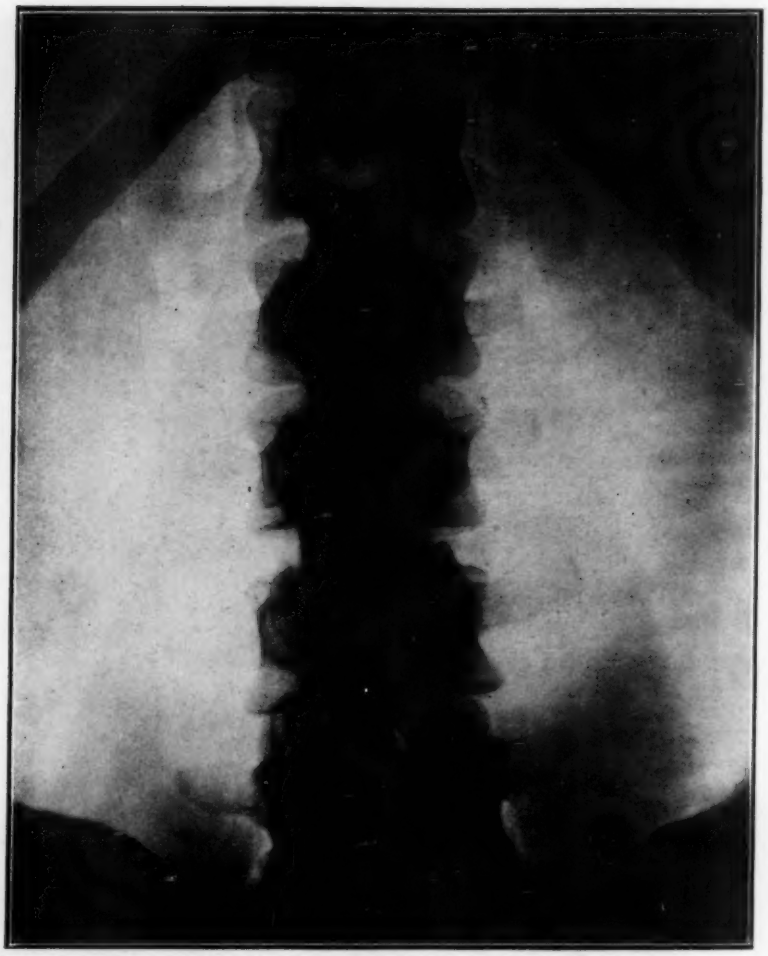

FIGURE 4

Spine of an individual of heavy anatomic type with four lumbar vertebrae showing the greater lateral breadth of the bodies of the vertebra than is peculiar to the text book normal, with the lessened proportionate thickness of the vertebra measured in the lost axis of the body. The transverse processes are short and strong. The spinous processes are strongly formed, the tip of several is broadened to over-ride the process below and the processes are in such close contact that very slight backward bending would be possible. The articular processes are crescentic with vertical axes and naturally allow very little lateral bending of the body. The last ribs are very long and of the heavy type of structure. The sacrum is placed low between the ilia as it frequently is in the heavy anatomic type.

FIGURE 5

A spine of the heavy anatomic type with four lumbar vertebrae with partial lumbalization of the upper sacral segment. Note the strongly formed and horizontally placed last ribs. Contrast the length with those of Figure 4.

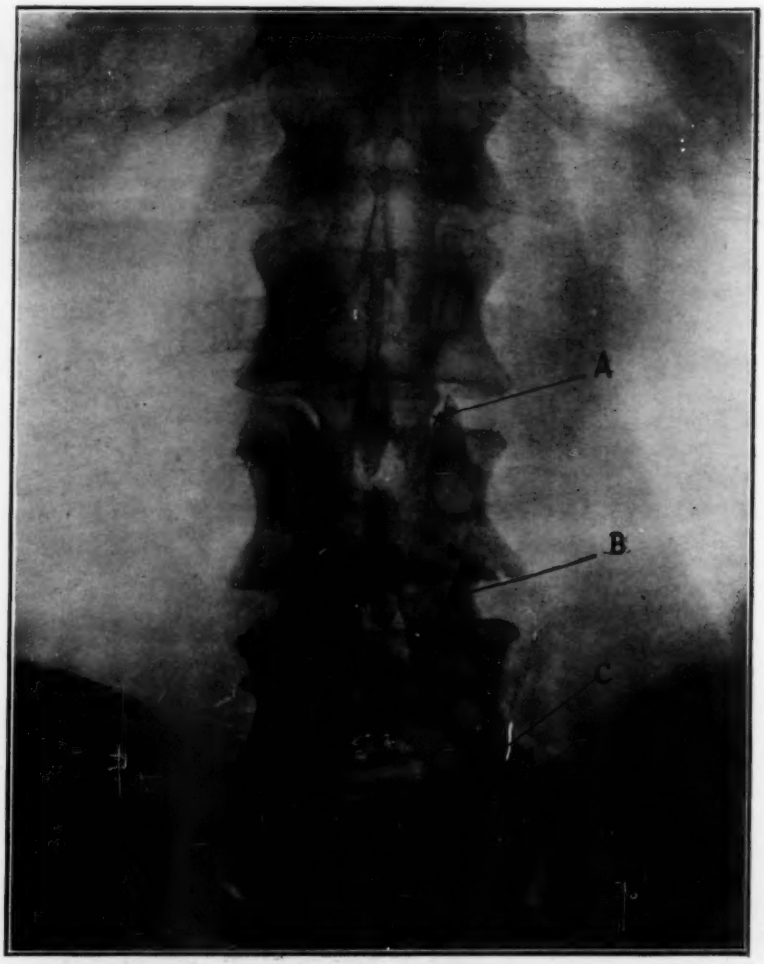

FIGURE 6

A spine of the heavy anatomic type with the sacrum set well below the crests of the ilia with the last lumbar vertebra much lower than is normal. The relatively short torso of the patient pictured above is due not to a smaller number of lumbar vertebrae but to the fact that the last lumbar vertebra is entirely below the level considered normal according to the text books of anatomy. The possibility of impingement between the transverse processes of the last lumbar to the wings of the ilia must be obvious. In this case also the last ribs are short and relatively straight out at the side so that the possibility of the pressure of the 11th rib against the tip of the 12th rib wih resulting pain at the point, is obvious. The crescentic articulations (A. B. C.) in these vertebrae are clearly shown but from the second to the fifth vertebrae the articulations are much more oblique than is normal, see Figures 2, 3 and 4, with a natural influence upon the mobility of the spine.

FIGURE 7

A spine of the heavy anatomic type with the broad relatively thin lumbar vertebra. Note the strong, heavily formed and horizontally placed lower ribs, with the left one so placed that with very little downward displacement of the 11th rib on that side, pressure upon the intercostal nerve at that point could easily be made. This case also illustrates the very narrow sacrum in contrast to Figure 1 or Figure 8.

FIGURE 8

The first four lumbar vertebra have the characteristics of the text book normal. At times the last lumbar vertebra is a mere narrow circular ring with almost no body to the vertebra present. The above illustration shows one of these conditions showing it rather imperfectly, but a condition which has been checked up by many plates which show only a rudimentary ring entirely detached from the sacrum, with a true articulation with the fourth lumbar vertebra. The ribs in the above illustration are distinctly in keeping with the structure of the slender anatomic type, and are a marked contrast to the shape and size of the ribs in Figure 4 and Figure 9.

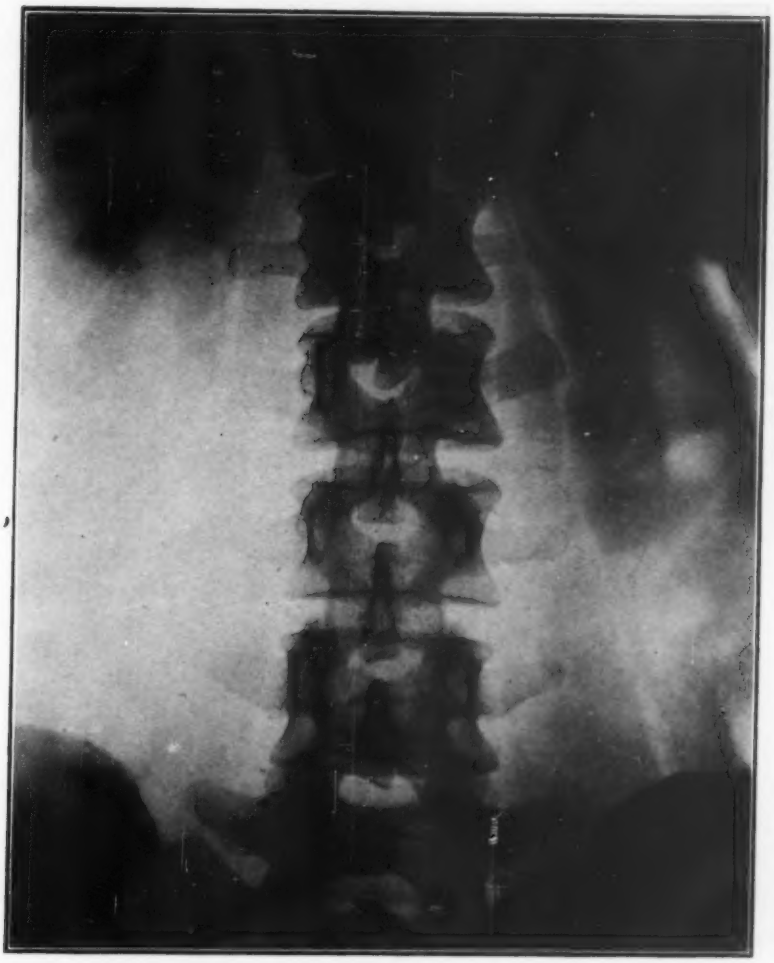

FIGURE 9

The six lumbar vertebrae in the above illustration are of the broad and thin type with the crescentic articulations closely locked which makes lateral mobility of this type of spine difficult. The long last ribs with the narrow neck are characteristic of the slender anatomic type and the downward displacement naturally results in forcing the diaphragm and the viscera downward, especially in the upright position, condition which must be aggravated when the ribs are as long, with tight clothing worn over the upper abdomen.

FIGURE 10

The shape of the vertebra in the above illustration is in keeping with that of the slender anatomic type and the sacrum is placed high which causes the apparent increase in the length of the lumbar spine. Upon the last dorsal vertebra upon the left side is an anomalous formation, apparently a rudimentary rib. This vertebra from the shape of the articular processes is evidently a dorsal vertebra and not a lumbar vertebra. The eleventh rib is long, slender at the neck and displaced downward as would be expected in the slender individual with the loosely attached viscera and the resulting low diaphragm. There are four unquestioned lumbar vertebrae with the partial lumbalization of the first sacral segment.

FIGURE 11

The illustration above shows a slender type of spine in the four upper lumbar vertebrae, but with the broad heavy type of vertebra for the fifth. The ribs in this case are of the slender type, with the exception of the last rib upon the right side which is much heavier in its general structure than the others.

FIGURE 12

The above illustration shows the type of vertebra common to the heavy anatomic type, which are broad laterally but relatively thin in the horizontal axis of the body, with the distinct crescentic articulations, with the articulations, A. and B., arranged in vertical planes. The first segment of the sacrum as is shown by the laminae and the spinous process is partly formed as a lumbar vertebra. The ribs in this case are long and of the shape of the normal type. The downward displacement is that which would be expected in the slender type and would naturally be increased by the use of improperly fitted corsets.

FIGURE 13

The width of the sacrum varies much with individuals, both male and female. The above figure shows a wide sacrum with a spine of the normal type leaning toward the slender with rudimentary last ribs. The possibility of the impinging of the 11th rib against the tip of the rudimentary 12th rib, with the pressure upon the intercostal nerve, must be obvious. Only four lumbar vertebrae are present in this case; the last dorsal vertebra or the vertebra having the rudimentary ribs attached, apparently having the characteristics of a dorsal vertebra.

FIGURE 14

The last lumbar in the above illustration shows a distinct lumbo-sacral transverse articulation upon the left side between the enlarged transverse process to the top of the sacrum. With the difference in the mobility of the two sides at this level, the rotation which begins at this level, in the above illustration, is fairly easy to understand. The imperfectly formed last rib upon the left side, and the short last rib upon the right, simply serves to emphasize the irregularities and the variations in the type of anatomy in this region.

understood, if the position which the long low ribs assume is considered in the relaxed posture so commonly seen in men and women, a part of which is the increase of the lumbar spinal curve with the backward inclination of the dorsal spine. In this position the ribs are in a plane well posterior to the transverse processes of the first lumbar vertebra and the catching of one upon the other becomes a question only of special shape or special move-

FIGURE 15

The spinous processes at times, as shown above, are large and heavy, and become twisted as the result of the over-riding in the relaxed postures, so common at the time of adolescence. The possibility of pain developing as the result of the actual contact between these processes as the result of the continued or increased relaxed habits of carriage, must be obvious.

ment. The relief of pain by raising the ribs, with the correction of the posture, or in the acute cases by bending the patient away from the side upon which the pain is, leads to little question as to the nature of the difficulty.

The study of the anatomic structure of this dorso-lumbar region shows that there is quite as much variation in the shape and position of the bones of this region as has come to be recognized

as existing in the low lumbar region. Since an exact knowledge of the structure of the individual seeking treatment is obviously essential if satisfactory results are to be obtained, this series of plates is presented.

In endeavoring to understand and to relieve the symptoms presented by a patient it must be remembered that every portion of the structure of this part of the skeleton varies at times. The shape of the body of vertebra varies, not only from the so called

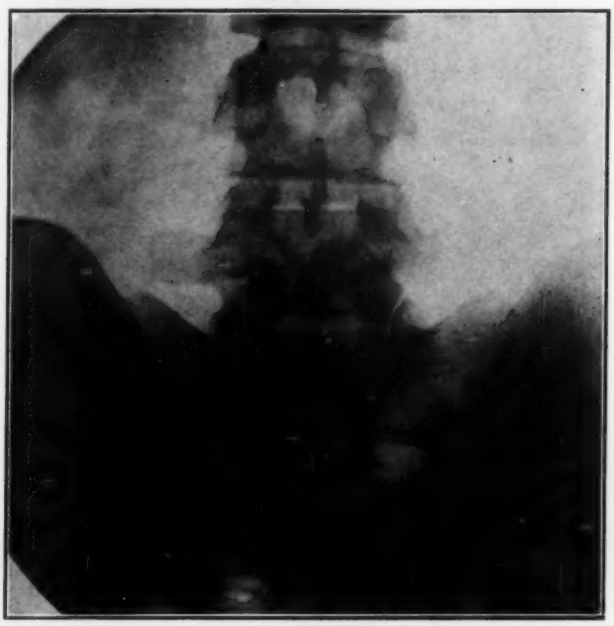

FIGURE 16

The articular processes of the lumbar spine, while according to the text books on anatomy are crescentic, at the same time are not always formed with the line of the articulation in the same plane on the two sides. In the left side of the above plate the line of the articulation is vertical, while on the right side it is distinctly oblique, leading to different degrees of motion on each side of this joint.

normal, but may show several different types in a single individual spine. The spinous processes vary in length, thickness and inclination, as is true of the transverse processes. The articular processes vary in shape, being flat, Fig. 17, with lateral plane or crescentic, Fig. 18, and in the latter the chief plane of the articular surface may be antero-posterior on a vertical plane—

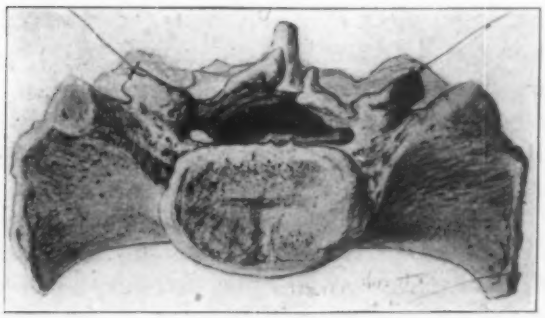

FIGURE 17

Top of sacrum showing the flat articular processes.

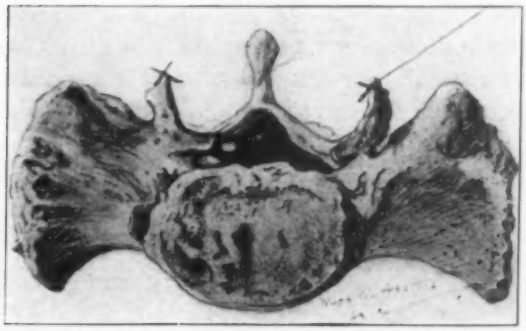

FIGURE 18

Top of sacrum showing the crescentic articulations into which the processes of the vertebra above are naturally locked.

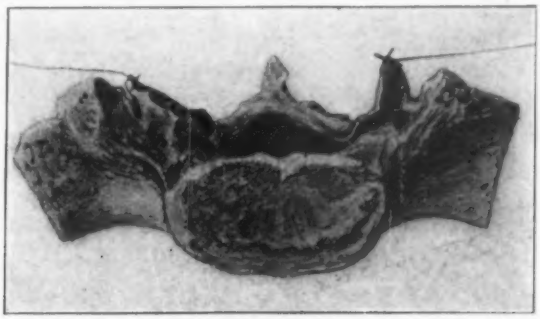

FIGURE 19

Top of sacrum showing a flat articular process upon the left side, with a crescentic articular process upon the right side.

Figs. 2, 3, or 4, or oblique—Figs. 6 and 16. Such differences not only occur but differences may exist upon the two sides or at different levels in one individual. Fig. 19.

In interpreting the symptoms in a given case all of these things must be taken into account. The heavy spinous processes will naturally limit backward bending. The crescentic articulations will naturally limit side bending more than the flat articulation. The heavy transverse processes upon the last lumbar naturally come in contact with the sacrum more easily than the small so called normal process. The excessively broad transverse process with the articulation with the top of the sacrum, not only introduces another joint which may become diseased, but a joint which because of the unnatural mechanics involved, is particularly apt to be strained. The narrow lumbar vertebrae naturally tend to flexibility of spine; the broad and thin vertebrae naturally tend to stability and inflexibility of the spine. With a careful anatomic analysis of a case with the appreciation of the possible mechanics, most cases become understandable and relief fairly easy to secure.

I am indebted to Dr. Lawrie Morrison for the roentgenological study of these cases, the illustrations of which are used as the basis of the paper.

Announcement

NEWLY ELECTED OFFICERS OF THE AMERICAN ORTHOPEDIC ASSOCIATION 1920-1921

President—Robert B. Osgood, 372 Marlborough St., Boston, Mass.

President-Elect—Nathaniel Allison, Humboldt Bldg., St. Louis, Mo.

Vice President—John P. Nutt, 55th St., and 7th Ave., New York City.

Secretary—W. W. Plummer, 523 Franklin St., Buffalo, N. Y.

Treasurer—John L. Porter, 7 West Madison St., Chicago, Ill.

Executive Committee

R. B. Osgood, 372 Marlborough St., Boston, Mass.
Nathaniel Allison, Humboldt Bldg., St. Louis, Mo.
David Silver, 7045 Jenkins Arcade Bldg., Pittsburgh, Pa.
John L. Porter, 7 West Madison St., Chicago, Ill.
W. W. Plummer, 523 Franklin St., Buffalo, N. Y.

Membership Committee

W. E. Gallie, 143 College St., Toronto, Ont.
Reginald Sayre, 14 West 48th St., New York City.
Edwin W. Ryerson, 122 South Michigan Ave., Chicago, Ill.
Michael Hoke, 72 West Peachtree St., Atlanta, Georgia.
Charles F. Painter, 522 Commonwealth Ave., Boston, Mass., Chairman.

Program Committee

James W. Sever, 234 Marlborough St., Boston, Mass.
Lloyd T. Brown, 372 Marlborough St., Boston, Mass.
W. E. Gallie, 143 College St., Toronto, Ont., Chairman.

Editorial Committee

John L. Porter, 7 West Madison St., Chicago, Ill.
F. J. Gaenslen, 141 Wisconsin St., Milwaukee, Wis.
Edwin W. Ryerson, 122 South Michigan Ave., Chicago, Ill., Chairman.

Editor

H. Winnett Orr, 1010 Terminal Bldg., Lincoln, Nebraska.

Editorial

The July Journal has been slightly delayed awaiting discussions at the June meeting of important papers in this issue. In August and thereafter the Journal will be issued on time. Much valuable material is on hand for publication.

Among these are papers of importance by Dr. Lovett, Dr. Whitman, Dr. Steindler, Dr. Rogers, and others, read at the Toronto meeting. In addition a very valuable communication has just been received from Dr. Allison on the Orthopedic Surgery of the Forward area during the war. It is hoped that it may be arranged to publish later a comprehensive article on Orthopedic Surgery in the Base Hospitals in France, to follow the article by Dr. Allison.

The Journal of Orthopaedic Surgery—the real Journal of reconstructive surgery—has made its greatest progress during the past year. Incidentally, the subscription price of the Journal was increased at the Toronto meeting to $5.00 per year.

Meeting of London Fellowship of Medicine

The London Fellowship of Medicine and Post Graduate Association was formed in 1918. Sir William Osler was president at the time of his death. The object is to correlate and render more easily available the lectures and clinics in London. A weekly Bulletin is issued. The following is the program in Orthopaedics for the week of June 14:

Monday, June 14
- 9:00 Royal Nat. Orthopaedic H.....Mr. Trethowan (Opns.)
- 1:30 Guy's Orthopaedic H.....Mr. Trethowan (O. P.)
- 1:30 St. Bartholomew's Orthopaedic H.....Mr. R. C. Elmslie (O. P.)

Tuesday, June 15.
- 1:30 St. Bartholomew's Orthopaedic H.....Mr. Elmslie (Opns.)
- 2:00 St. Thomas's Orthopaedic H.....Mr. Bristow (O. P.)

Wednesday, June 16.
- 1:30 Guy's Orthopaedic H.....Mr. Trethowan (O. P.)

Thursday, June 17.
- 1:30 St. Bartholomew's Orthopaedic H.....Mr. Elmslie (O. P.)
- 2:00 Roy. Nat. Orthopaedic H.....Mr. Trethowan (O. P.)
- 3:00 St. Bartholomew's Orthopaedic H.....Mr. Elmslie (Opns.)

Friday, June 18.
- 10:00 London Orthopaedic H.....Mr. Openshaw
- 1:00 London Orthopaedic H.....Mr. Openshaw (Lecture)
- 2:00 Westminster Orthopaedic H.....Mr. E. Rock Carling

Orthopaedic Titles in Current Literature

Prepared by Dr. J. E. M. Thomson, Lincoln, Nebraska.

Andrews, E. W.—Two Cases of Myeloma. Surg. Clin., 1920, IV, p. 43.

Ansinn, K.—Wire Versus Nail Extension. Zentralblatt fur Chirurgie, March 13, 1920, 47, No. 11, p. 249.

Armstrong, Richard R.—Case of Cervical Caries Simulating Cerebellar Tumour. British Med. Journal, April 10, 1920, p. 499.

Babcock, W. Wayne.—The Immediate Sterilization and Closure of Chronic Infected Wounds; A New Method Applicable to Wounds of Bones and Soft Tissues. Am. Med. Ass'n. Journal May 8, 1920, Vol. 74, No. 19, p. 1301. (See abstract in this issue.)

Bahr, F.—Isolated Fracture of Coronoid Process of Ulna. Deutsche Zeitschrift fur Chirurgie, August, 1919, 151, No. 1-2, p. 100.

Barnard, F. S.—Bone Graft. Pacific Coast Journal Homeop., 1920, XXXI, p. 58.

Beck, C.—Ununited Fractures of the Tibia and Fibula, Repair by Open Operation and Wiring of Fragments. Surg. Clin., Chicago, 1920, IV, p. 115.

Plastic on the Heel. Surg. Clinic Chicago, 1920, IV, p. 109.

Beck, O.—Spina Bifida Occulta and Congenital Club Foot. Munchener Medezinische Wochenschrift. March 12, 1920, 61, No. 11, p. 316.

Behan, R. J.—Bone Inlays and Bone Platings. Annals of Surgery, March, 1920, 71, No. 3, p. 377.

Benefield, C. E.—Various Methods of Treating Fractures. Arkansas Med. Soc. Journal. March, 1920, 16, No. 10, p. 193.

Benet, G.—Conservative Treatment of Compound Fractures. S. Carolina Med, Ass'n Journal, March, 1920, 16, No. 3, p. 62.

Bossert, O.—Friedmann Treatment of Children with Surgical Tuberculosis. Deutsche Medizinische Wochenschrift, Jan. 8, 1920, 46, No. 2, p. 41.

Brade-Birks, H. K.—Bone Condition Analagous to Rickets in Child of Five Months. Lancet, March 27, 1920, 1, No. 5039, p. 712.

Bratrud, A. F.—The Diagnosis and Treatment of Peripheral Nerve Injuries. Minnesota Med., 1920, III, p. 57.

Brenizer, A. G.—The Use of Intramedullary and Extracortical Beef-bone Splints in the Repair of Fractures of the Long Bones. Surg. Gynec. and Obst., 1920, XXX, p. 209.

Brooke, J. A.—Amputations; the Preparation of the Stump and the Fitting of Artificial Limbs. Hahneman Month, 1920, LV, p. 122.

Brown, Lloyd T.—Bodily Mechanics and Nutrition. Boston Med. and Surg. Journal, 1920, CLXXXII, p. 187.

Bryan, L.—Bony Changes in Feet Following Fracture of Vertebrae. Am. J. of Roentgenology, March, 1920, 7, No. 3, p. 125.

Budde, M.—Movements of Knee with Injury of Anterior Crucial Ligament. Deutsche Zeitschrift fur Chirurgie, Nov., 1919, 151, No. 5-6, p. 343.

Congenital Lumbosacral Scoliosis. Deutsche Zeitschrift fur Chirurgie, Nov., 1919, 151, No. 5-6, p. 343.

Buzzard, E. F. and Reddock—Case of Spastic Quadriplegia Following Injury to the Spinal Cord in the Upper Cervical Region Showing Certain Unusual Reflex Phenomena. Proc. Roy. Soc. Med., London, 1920, XIII, Sect. Neurol., p. 47.

Ceserano, M.—Tuberculosis of the Hip in Congenital Dislocation. La Chirurg. organi di movimento, Dec., 1919.

Colcord, A. W.—Injuries of the Finger Nail. Internat. Jour. Surg., 1920, XXXIII, p. 33.

Davis, C. B.—Extradural Fibroma of the Spine. Surg. Clin. Chicago, 1920, IV, p. 123.

Lymphosarcoma of the Spine. Surg. Clin., Chicago, 1920, IV, p. 119.

Davis, B. F.—Traumatic Separation of the Upper Femoral Epiphysis. Surg. Clin., 1920, IV, p. 143.

Ulnar Paralysis. Surg. Clin., Chicago, 1920, IV, p. 127.

Debrunner, H.—Orthopedic Therapy in Foot Deformities with Neural Progressive Muscular Atrophy. Deutsche Medizinische Wochenschrift. Dec. 25, 1919, 45, No. 52, p. 1437.

Ducamp and Carrieu—Alternating Scoliosis with Sciatica. Bulletin de la Societe Medical des Hopitaux, Feb. 27, 1920, 44, No. 8, p. 265.

Durand—Recurring Luxation of the Shoulder, External Capsulorraphy. Lyon Chirurg., 1919. XVI, p. 404.

Eikenbary, C. F.—Congenital Equinovarus, Report of 114 Cases. Surg. Gynec. & Obst., June, 1920, Vol. XXX, No. 6, p. 555.

Elsbarg, C. A.—Concerning Spinal Cord, Tumors and Their Surgical Treatment. Am. Jour. Med. Soc., 1920, CLIX, p. 194.

Fasano, M.—Bone and Joint Surgery. Gazz. d Osp. 1919, XL, p. 731.

Feiling, A.—Two Cases of Intramedullary Tumor of Spinal Cord; Operation. Lancet, May 1, 1920, 1, No. 18, p. 957.

Gatewood—Dislocation of the Hip with Fracture of the Acetabulum. Surg. Clin. Chicago, 1920, IV, p. 77.

Gayet—Pan-Osteitis of the Humerus. Lyon Med., 1919, CXXVIII, p. 602.

Giessler, P. W.—Foot Disabilities. Lancet, 1920, XL, p. 65.

Gill, A. B.—Bone Transplantation for Old Ununited Fracture. Ann. Surg., 1920, LXXI, p. 228.

Giraud, G.—Contracture of the Fingers. Progres Medical. March 13, 1920, 35, No. 11, p. 113.

Goodman, R.—The Pathology and Treatment of Chronic Osteomyelitis in Unhealed War Wounds. Therap. Gaz., 1920, XLIV, p. 94.

Goodman and W. J. Young—A Clinical Pathological Study of an Unusual Syphilitic Manifestation Resembling Juxta-Articular Nodules. Am. J. Med. Science, 1920, CLIX, p. 231.

Green, N. W.—Central Luxation of the Femur. Ann. Surg., 1920, LXXI, p. 226.

Hawkes, F.—Refractured Femur with Plating. Ann. Surg., 1920, LXXI, p. 203.

Hoffmann, V.—Osteo-Arthropathy. Deutsches Archiv für klinische Medizin., Sept. 26, 1919, 130, No. 3-4, p. 201.

Hogler, F.—Drumstick Fingers and Osteo-Arthropathy. Wiener Archiv fur innere Medizin., March 1, 1920, 1, No. 1, p. 35.

Hohman, George—Indications for Tendon Transplantation in Paralysis of Peripheral Nerves. Muench. Med. Wochenschrift. Nov. 26, 1918, No. 48.

Hutchins, C. P.—Weakened Foot. Its Measurement and Correction. Med. Record, April 24, 1920, 97, No. 17, p. 677.

Julliard, C.—Fat Cartilage and Bone Graft in Surgical Repair. Revue Medicale de la Suisse Romande, April, 1920, 40, No. 4, p. 211.

Key, E.—A Case of Osteitis Fibrosa Femoris Treated by Resection. Acta Chirurg. Scand., 1919, LII, p. 267.

Kimptom, A. R.—Cysticerus Racemosus (Taenia Solium) Infection of the Spinal Cord with Report of a Case. Surg. Gynec. & Obst., 1920, XXX, p. 198.

Kleemann, Margarete—Test Pressure on the Vagus. Deutsches Archiv. fur klinische medizin., Sept. 26, 1919, 130, No. 3-4, p. 221.

Kleinschmidt—Contracture of Great Toe. Zentralblatt fur Chirurgie, March 13, 1920, 47, No. 11, p. 243.

Kouindjy, P.—Re-Education of Hemiplegics and their Physiotherapeutic Treatment. New York Med. Journal, May 22, 1920, III, No. 21, p. 884.

Kurtz, A. D.—Metatarsalgia and Allied Conditions. New York Med. Journal, 1920, CXI, 329.

Latarjet—The Influence of Muscle Resections upon the Growth of Bone. Lyon Med., 1919, CXXVIII, p. 557.

Layne, P. C.—Focal Infection in Relation to Bones and Joints. Kentucky Med. Journal, April, 1920, 18, No. 4, p. 122.

Lemon, C. H.—Suggestions for Treatment of Fracture of Radius and Ulna at Middle Third. Wisconsin Med. Journal, April, 1920, 18, No. 2, p. 465.

Leopold, J. S.—Spina Bifida Occulta in a Child with Incontinence of Urine and Faeces; Improvement in Vesical Control after Operation. J. Am. Med. Ass'n., 1920, LXXIV, p. 439.

Leriche, R.—Anatomical and Functional Results of Aseptic Primary Resection of the Shoulder. Lyon Chirurg., 1920, XVI, p. 439.

The Functional Result after Arthrotomy of the Knee done after Detaching the Anterior Tuberosity of the Tibia. Lyon Chirurg., 1919, XVI, p. 461.

Leriche and Policard—Bone Regeneration in Aseptic Surroundings. Lyon Chirurg., 1919, XVI. p. 467.

Lord, J. P.—Preservation of Function in Joints. Nebr. State Med. Journal, March, 1920, 5, p. 74.

Lovett, Robert W.—The Tripod Method of Walking with Crutches as Applicable to Patients with Complete Paralysis of the Lower Extremities. J. of Am. Med. Ass'n. May 8, 1920, Vol. 74, No. 19, p. 1306.

Lynch, Frank W.—The Pelvic Articulations During Pregnancy, Labor and the Puerperium—an X-Ray Study. Surg. Gynec. & Obst., June, 1920, Vol. XXX, No. 6, p. 575.

Marshall, H. W.—The Treatment of Back Injuries with Special Reference to Spinal Fractures that are not Associated with Cord Symptoms. Boston Med. & Surg. Journal, 1920, CLXXXII, p. 140.

Masland, H. C.—Form of Splint Available in Treatment of Fracture of Neck of Femur. Annals of Surgery, April, 1920, 71, No. 4, p. 501.

McArthur, L. L.—Sarcoma of the Posterior Tibial Nerve, Excision, Removal of Metastatic Foci in Retroperitoneal, Lymph Glands Three Months Later. Surg. Clin., Chicago, 1920, IV, p. 181.

McCurdy, D. L.—Focal Putrefactions and their Bearing on Osteo-Arthritis and Other Diseases. J. Orthop. Surg., 1920, II, p. 92.

McWhorter, G. L.—Arthrotomy of the Knee Joint Under Local Anaesthesia for the Removal of the Medial Meniscus. Surg. Clinic, Chicago, 1920, IV, p. 155.

Mennell, J. B.—Some Remarks on Bone Setting, the Practice and Results of Forced Movement. Lancet, 1920, CXCVIII, p. 297.

Mewburn, F. H.—Observations on Lesions of Peripheral Nerves with Special Reference to Postoperative Treatment. Med. Quarterly, 1920, 1, p. 279.

Meyerding, H. W.—Chondromas. J. Orthop. Surg., 1920, II, p. 77.

Montemaguo, D.—Surgical Treatment of War Amputation Stumps. Chir. d. Organi di Movimento, 1919, III, p. 201.

Mosti, R.—Fractures of the Anterior Tubercle of the Tibia. Riforma Med., 1919, XXXV, p. 693.

Neff, James, M.—A New and Efficient Method for the Use of Wire in Surgery of the Bones. Surg. Gynec. & Obst., June, 1920, Vol. XXX, No. 6, p. 612.

Niles, G. M.—Mechanical Method of Supporting Abdominal Walls and Viscera. Georgia Medical Ass'n. Journal, Feb., 1920, 9, No. 10, p. 53.

Patel—Extensive Resection of the Left Shoulder; Loose Shoulder Myoplasty. Lyon Chirurg., 1919, XVI, p. 456.

Pellegrini, A.—Motor Plastic Operations; Cinematization. Riforma Medica. Dec. 20, 1919, 35, No. 51, p. 1122.

Perkins, J. W.—Hitherto Undescribed Dislocation of the Patella Endwise. J. Am. M. Ass'n., 1920, LXXIV, p. 388.

Plate, E.—Radiating Pains in Shoulder. Munchener Medizinische Wochenschrift. March 12, 1920, 67, No. 11, p. 313.

Poggiolini, A.—Mixed Sarcoma in Popliteal Space. Policlinico Rome. March 8, 1920, 27, No. 10, p. 300.

Portmann, G.—Mastoiditis and Suboccipital Pott's Disease. Revue de Chirurgie, Nov., Dec., 1919, 38, No. 11-12, p. 916.

Powers, J. W.—Some Phases of Reconstruction Surgery. Wisconsin Med. Journal, March, 1920, 18, No. 10, p. 417.

Rohde, K.—The Pathogenesis of Bone Cysts. Berliner klinische Wochenschuft, Dec. 15, 1919, 56, No. 50, p. 1184.

Rojas, Loa R.—Albee's Operation for Pott's Disease. Gaceta Medical de Mexico, Feb., March, 1920, 55, No. 5.

Roth, P. B.—Stiff Knee in Relation to Compound Fracture of Femur. British Med. Journal, 1919, Vol. 3064, p. 395.

Rozies—Treatment of Burns. Progress Medical, March 13, 1920, 35, No. 11, p. 118.

Ryan, W. J.—Fractures of Pelvis. Annals of Surgery, March, 1920, 71, No. 3, p. 347.

Saner, T. D.—Plating of Simple Fractures. Lancet, London, April 10, 1920, 1, No. 5041, p. 812.

Schenk—Gunshot Wounds of the Joints. Deutsche Zeitschrift fur Chirurgie, July, 1919, 150, No. 304, p. 152.

Schwyzer, Gustav—Tuberculosis of the Joints; Rollier's Heliotherapy. Surg. Gynec. & Obst., June, 1920, Vol. XXX, No. 6, p. 581.

Speed, K.—Projectile Fractures of Long Bones. Annals of Surgery. April, 1920, 71, No. 4, p. 493.

Stoney, R. Atkinson—Modern Methods in the Removal of Projectiles. Surg. Gynec. & Obst., June, 1920, Vol. XXX, No. 6, p. 621.

Strauss, O.—Radiotherapy in Surgical Tuberculosis. Deutsche Medizinische Wochenschrift. Jan. 8, 1920, 46, No. 2, p. 39.

Symonds, C. P.—A Case of a Lesion of the Suprascapular Nerve and First Dorsal Root, with Hemisection of the Cord Produced by a Single Missile. Proc. Roy. Soc. Med., London, 1920, XIII, Sect. Neurol., p. 43.

Thevenet—Complications of Knee Sprain. Revue de Chirurgie. Nov., Dec., 1919, 38, No. 11-12, p. 916.

Thomson, J. E. M.—Mechanical Treatment of Compound Fractures of the Upper Extremity. Nebr. State Med. Journal, May, 1920, Vol. V, No. 5, p. 140.

Toussaint, M.—Operation on Nerves. Gaceta Medica de Mexico. Jan., 1920, 1, No. 4, p. 3.

Tuffier—Cinematic Amputations. Bull. Acad. de Med., Paris, 1920, LXXXIV, p. 51.

Wassertrudinger, D.—Wax and Paraffin to Plug Cavities in Bones. Deutsche Zeitschrift fur Chirurgie, Nov., 1919, 151, No. 5-6, p. 319.

Zeno, A. and A. Boden—Fistulae and Sacrococcygeal Cysts. Semana med., 1920, XXVI, p. 181.

Current Orthopaedic Literature

APPLICATION OF MILITARY SURGERY TO CIVIL PRACTICE... C. Gordon Shaw, D. S. O., M. D., F. R. C. S. *Medical Journal of Australia*, January, 1920, Vol. I, 3.

The recent war has left its effects on every department of national life. Reconstruction is the order of the day. It is inevitable that the principles and practice of surgery should be profoundly affected by the lessons taught and knowledge gained during the war.

Flesh Wounds—The principles involved in the treatment are given:

1. The wound should be thoroughly cleansed, devitalized, and damaged tissue excised. Blood clots are removed, as well as foreign bodies.

2. Measures are taken to sterilize the wound. Among the materials used are:

(a) Carrel Dakin solution.
(b) Fluorine.
(c) Salt pack.
(d) Spirits and "B. I. P. P."

The bismuth-iodoform paraffin paste is the author's preference.

3. Whether primary or secondary suture is performed depends on the case. Factors to be considered are:

(a) The length of time since receipt of injury. After eight hours, bacterial multiplication has begun to spread to surrounding tissues, making primary suture less likely to be successful.

(b) Contusion and devitalization of tissue predisposes to sepsis.

(c) Situation of the wound. Parts with rich blood supply are less likely to develop sepsis.

(d) The obvious cleanliness of the wound. Infected material and dirt may be ground into the wound.

(e) Whether patient has lost considerable blood, as exsanguinated patients are more susceptible to infection.

Septic Wounds—Tetanus was practically wiped out by the use of prophylactic injection of anti-tetanus serum and the follow-up weekly injections. Gas gangrene was dealt with early by excision of all infected tissue, and washing out with peroxide solution. If the infection had progressed, amputation would have been necessary.

A polyvalent anti-gas gangrene serum was developed which would have answered a similar purpose as the anti-tetanus serum had not the armistice brought an end to this class of cases.

Often this organism existed in the wounds as a harmless saprophyte, giving no trouble for weeks or months after; when, after wound healing had taken place, symptoms flared up as the result of irritation, injury, or surgical interference. Among the activators of tetanus and gas gangrene are the toxins of the streptococcus, the appearance of calcium and rare earths.

For the prevention of the symptoms, then, (a) Secondary infection by streptococcus should be prevented. (b) Wound should be washed out to remove calcium salts. (c) Anti-streptococcus serum should be administered.

Latent Sepsis—Sepsis following secondary operations, even months after wound has healed, often chagrin the surgeon. They are due, by hypothesis, to organisms absorbed from the septic wound by the blood stream and deposited in other parts of the body, where they may remain latent until caused to flare up by some injury. The same cause may be the reason for stiff joints following wounds of the extremities.

If, before operation, the old wound is ionized with salicylic ions for from three to seven days, the scar is softened and sterilized so that the time elapsing between the healing of the wound and operation, say, for repair of nerves, was reduced to two weeks.

Wounds of Joints—The experience of the war has established the fact that the synovial membranes are very resistant to infection. The treatment may be considered under the following headings:

I. Bullet wounds of the joint, without injury to the bone. These should be let alone until or unless symptoms develop. Blood should be aspirated.

II. Lacerated wounds of the joint, without bone injury. Here the wound should be cleaned up, synovial membrane sutured, and entrance wound sutured or not, as the surgeon thinks fit.

III. Wounds of joints associated with bone injury depend upon the joint involved. In the case of the knee, ankle and shoulder, strength and stability of the articulation are of primary importance, while mobility is of secondary importance, while with the elbow and wrist, mobility is very essential. Every bone injury should be thoroughly exposed and completely cleaned, and dead or devitalized bone removed.

Where injury is slight, damaged portions of bone may be gouged out. If injury is severe, excision of the joint should be performed. Flail elbow from excision of this joint is not uncommon, and indeed difficult to treat. The author cleans each fragment of bone separately and places them in proper apposition with the hope of obtaining union by first intention and ankylosis. When impossible to eliminate sepsis without the removal of so much bone that a flail joint must result, apparatus should be worn that will strengthen and stabilize joint, or bone grafting be done to establish false joint or ankylosis.

Septic Joints—The writer had the good fortune not to have many of these cases. Among the methods of treatment mentioned are (1) In early stages, aspiration; (2) A combination of aspiration and irrigation of the joint; (3) Drainage and "B. I. P. P." after arthrotomy. The Fullerton method consists of excision of joint and keeping the ends of the bones apart. The wound is left open for thorough irrigation and drainage.

Compound Fractures—These should be operated upon as early as possible. Among the favored procedures are:

First, the French method of removing all partly detached fragments of bone subperiosteally. In this manner the wound can be more thoroughly cleaned and

there is less risk of sepsis. Bone re-forms and the gap is filled. Careful splinting is essential.

The second method consists of carefully cleaning those fragments attached *in situ* and the removal of those detached, cleaning them with ether and replacing them in proper relation after wound has been cleaned.

Proper splinting is carried out. In this procedure the detached fragments form a scaffolding for the growth of new bone. However, these fragments predispose to infection.

Emphasis is laid on the replacement of wooden splints by metal standardized splints, which will mean a definite advance as applied in civil practice.—*J. E. M. Thomson.*

DISLOCATIONS OF THE DISTAL PHALANX OF THE THUMB. G. Maurice. *Revue d'Orthopedie* xxvii, 113-166.

Anatomy—The interphalangeal joint of the thumb consists in a convex surface at the distal end of the proximal phalanx and the concave surface of the end of the distal phalanx. The convex surface has a regular curve in the anteroposterior plane, is divided by a sulcus into two condyles, the whole widening out toward the palmar side of the thumb. The concave upper end of the distal phalanx is divided into two lateral glenoid cavities by a longitudinal ridge which fits into the sulcus in the opposite joint surface. The synovial sac is rather extensive and forms a cul-de-sac up over the anterior aspect of the condyles.

Physiology—The joint is, therefore, a trochlear one and permits practically only the movements of flexion and extension. Flexion is not limited by the dorsal ligaments nor even by the extensor tendon, for it is noted that the limit of flexion is the same whether the tendon is tense or relaxed. The real obstruction is at the anterior aspect of the joint where the edge of the distal phalanx impinges on the anterior face of the proximal phalanx and where the anterolateral ligaments form a dense mass when compressed. Extension of the joint is also limited by the anterior ligaments rather than by the flexor tendon.

Etiology and mechanism—Statistics show that the distal phalanx of the thumb is dislocated much more frequently than that of the other four digits, the proportion being about 4 to 1; in fact, dislocation of any of the thumb joints is much more frequent than the same lesion in the finger joints. Posterior luxation is much more frequent than anterior. Of fifty-five cases reported by Polaillon only six were anterior. This, as well as the relative frequency of all dislocations of the thumb, is explained by the isolation and exposure of that digit and the usual direction of traumatizing force being backward. Probably the most common cause of backward dislocation is a fall with the thumb extended, which results in forced hyperextension of the distal phalanx. It is very difficult to produce this dislocation experimentally. Direct blows on the pulp of the thumb, the proximal phalanx supported on the edge of the table, are not effective. The only means of producing it is by forcible extension combined with a strong pressure upward in line with the axis of the thumb. The pressure upward is essential and if it is not exerted the distal phalanx may be hyperextended until

the dorsal surfaces of the two phalanges are in contact without a dislocation taking place. In the traumatic dislocations the downward thrust of the arm furnishes this longitudinal pressure.

Rupture of the glenoid ligament (anterior) is necessary to dislocation, at least in the living. As a matter of fact it is usually torn from its insertion, rather than ruptured. Integrity of the lateral ligaments is the rule according to most authors and experimental dislocation can be accomplished without rupturing them. Tearing of the flexor tendon is very rare in posterior dislocations, but it may be less rarely separated more or less from its insertion in the distal phalanx. The extensor tendon is never ruptured nor is the synovial sac on its dorsal wall.

The dislocation may be complicated by fracture either of the distal or of the proximal phalanx in some cases the fracture extending into the joint.

Two types of posterior luxation are described. The distal phalanx may be displaced at right angle to the proximal with the articular surfact of the former in contact with the dorsal side of the latter, the so-called primary type; or the long axes of the two phalanges may be parallel with only the anterior articular border of the distal against the dorsal surface of the proximal, the secondary type. The two types are so-called because it is held by some surgeons that the secondary is rarely the result of the original trauma but of attempts at reduction of the primary type. The author, however, holds that the secondary is the more common form of posterior luxation.

Obstacles to reduction—The most important of the conditions which prevent reduction is the interposition of fibrous or tendinous tissue between the joint surfaces, either the glenoid ligament, the flexor tendon, or both of these structures. Interposition of the capsule is impossible. Swelling of tendons, muscle, spasm, inflammation of soft parts, and the extreme brevity of the distal phalanx are not regarded as real obstacles to reduction.

Diagnosis is usually easy. The backward dislocation produces a deformity resembling the back of a fork. The axes of the two phalanges are in the same plane viewed from front or back, but from the side the axes may be either at an angle more or less obtuse or they may be parallel. If parallel there is overriding of the distal phalanz over the back of the proximal. Frequently, if not constantly, there is a transverse line of ecchymosis across the palmar surface of the joint. There is shortening of the entire thumb, there is no active motion, and attempts at passive motion cause much pain and very little movement.

The lesion is sometimes complicated by tear of the skin to such an extent that the head of proximal phalanx protrudes. This laceration is almost always transverse across the front of the joint. Another complication is ankylosis following irreducible cases, some of which come to amputation.

Treatment—Dislocations of not more than twenty-four hour's standing usually do not offer much difficulty to reduction. Later the inflammation and muscle spasm make the task harder. If the distal phalanx points backward at a right angle the method is simply to push it forward again. If the two phalanges are parallel the distal should first be bent backward, then pressure should be applied on its base from above down, and from behind forward. If reduction is difficult the thumb may be adducted over the palm thus relaxing the flexor

tendon which sometimes is an obstacle. Local anesthetic may be given if necessary around the base of the thumb rather than at the affected joint, to avoid further edema in the latter region. After the reduction it is well to fasten the thumb in a splint for some time to prevent recurrence.

According to Polaillon, about a fourth of the cases are irreducible. In these cases it is necessary to do an open operation. The best incision for this is a transverse semilunar one on the dorsal side, extending through about a third of the circumference of the thumb with its convexity downward so that the flap can be turned upward. On pulling the extensor tendon aside one can see the joint and determine the obstacle to reduction. If the flexor tendon and glenoid ligament are causing the trouble they may be pushed aside, if it is the lateral ligaments they may be cut. In some cases it may be necessary to do a resection in order to reduce the deformity. Compound dislocations must be well cleaned with iodin and the wound edges resected. Antitetanic serum should be given in all cases in which the patient sustained the injury in a fall alighting on the thumb.

Forward dislocations of the distal phalanx are much more rare than backward ones. They are usually the result of a fall in which the weight of the body came on the end of the extended thumb. This type of dislocation is peculiar to the thumb since it has not been observed in the fingers. It seems to be produced by a violent upward pressure when the thumb is in hyperextension. The lesion results in either of two types of deformity; the distal phalanx may be pointing backward over the end of the proximal, or it may be lying parallel with, and over riding the proximal phalanx in front. Diagnosis is easy; the only lesion with which the forward dislocation may be confused is a fracture at the base of the distal phalanx with forward displacement of the distal fragment.

Reduction of the angular type of deformity in anterior dislocations is easy, but more difficult in cases of over-riding of the phalanges. The mechanism is extension by traction on the distal phalanx accompanied by pressure from in front backward. Failure by this method is to be followed by open operation. Cases have been known to go unreduced and still have a fairly useful thumb.

Lateral dislocations are very rare, probably because of the great width of the bones as compared with their thickness. There is a displacement of the distal phalanx laterally and also an inclination of its long axis toward the same side.

Eight cases are reported, all posterior dislocations. Two of them were compound dislocations in one of which resection of the base of the distal phalanx was necessary. In another, an open operation was necessary to reduce the lesion.—*William Arthur Clark.*

A. FLOCKMANN ON THE KRUKENBERG HAND. Betr. z. Klin. Chir. Vol. 117 No. 3. 1919.

Krukenberg's technic is described as follows: A U shape incision made over the stump from the volar to the dorsal surface, the incision being placed nearer the ulnar side. The muscles are then dissected. The flexor sublimis is split longitudinally, the flexor profundis and flexor pollicis longus are removed. The extensor muscles of the thumb are also removed. The pronator quadratus and interosseus ligaments are divided. The ulna and radius are shortened and smoothed off. A groove is then placed into end of radius and ulna running horizontally in radio-ulnar direction. The radial half of the flexor digitorum sublimis is sutured to the flexor carpi radialis; the ulnar half of the flexor digitorum sublimis is sutured to the flexor carpi ulnaris. The extensors are dealt with as follows: On the radius there remains the supinator longus and extensor carpi radialis. On the ulna remain the extensor carpi ulnaris and extensor digitorum communis. The radial group of flexors (adductors) is sutured to the radial group of extensors (abductors). The ulnar group of flexors (adductors) is sutured to the ulnar group of extensors (abductors) over the stump. Then follows the covering with skin of the radial half taking a volar flap for the covering on its interosseus surface. This leaves only the interosseus surface of the ulnar half without skin. This defect is taken care of by a pedunculated flap from the abductors.

Removal of 1 to 2 cm. of bone is advised. In suturing different muscle groups together it is arranged so that the flexor muscles are placed on the interosseus surface of extensors on the outer radial or ulnar surface.

The pseudoarthroses were later abandoned or at least reserved only for the ulna, in exceptional cases.

In regard to distribution of muscles the original scheme of Krukenberg is as follows:

Abductor-flexors: biceps, pronator teres flexor carpi radalis and radial half of flexor digitorum sublimis.

Abductors extensors: supinator longus, extensor carpi radialis, longus and brevis; extensor digitorum communis.

Supination: supinator brevis.

Pronation: pronator teres.

The author's plan of muscle distribution is as follows:

Adductors: The ulnar 1/4 of flexors and extensors of fingers and flexor carpi ulnaris, also combined action of flexors and extensors.

Abductors: The radial 3/4 of flexors and extensors. Supinator longus, biceps, pronator teres.

Supinators: Supinator longus and extensors .

Pronation: Pronator teres and radial part of flexors.

The after treatment consisted of massage, galvanization and active motion.

The result in 4 out of 7 cases was ideal. The length of the stump was only 7 cm. The muscles were not divided too high up and the elbow was intact.

In conclusion the author points out that skin incision must be more on the ulnar side. In bone shortening over 2 1/2 cm. enough skin might be recovered by bayonet incision. Otherwise an abdominal flap must be made. The extirpa-

tion of muscle should be restricted as much as possible. If a pedunculated flap is used it should be severed on the 14th day. Long stumps are unfavorable. Nearthroses should not be made except possibly for the ulna in exceptional cases. —*A. Steindler, Iowa City, Iowa.*

RESULTS OF OPERATIONS ON PERIPHERAL NERVES. O. Stracker. Beitr. z. Klin. Chir. Vol. 17 No. 3.

Report on 369 cases, operation on 441 nerves.

Total resections 256, partial resections 46.

340 cases were re-examined sometime after operation. Of these 250 improved or 73½%. 48 cases cured or 14%.

Results of different operative procedures. A Neurolysis: 118 cases. Re-examined 91 cases. Cured 21 cases or 31%.

Other operators report improved or cured after neurolysis 84% (Wesberg), 76% (Ranzi), 69% (Perthes).

B. Resections. Operations on 302 nerves of which 256 were total resections.

Sutures performed in total resections 178 cases. Re-examined 147 cases. Of the latter 111 or 75% were improved, with return of function in at least one muscle; cured 19 cases or 12% with return of function in all muscles. Of the 19 cases cured, 13 were suture of the musculo-spiral, 4 of the median, one of the ulnar and one of the brachial plexus.

The operative results of other observers show a much lower percentage in this group; Forster 86%, Ranzi 50 to 40%, Perthes 37%.

Of the 101 nerve sutures of the upper extremities all proximal muscles recovered 48 times. Of the 41 sutures of the lower extremities all proximal muscles recovered only 4 times. In the small muscles of the foot return of function could never be ascertained absolutely. This speaks for lesser regenerative power of the lower extremities, probably due to greater distance from trophic centers.

Time of Regeneration:

Musculo-spiral nerve: Supinator longus and extensor carpi radalis, 5 to 11 months. Extensor digitorum communis and extensor carpi ulnaris 8 to 11 months. Thenar muscles after 12th month.

Nervus Ulnaris: Flexor carpi ulnaris and flexor digitorum profundus 3rd to 11th month. Intrinsic muscles of the hand after the 13th month.

Nervus Medianus: Flexor carpi radalis, pronator teres, flexor sublimis digitorum, 1st to 10th month. Flexor Pollicis Longus after 6th month. Thenar muscles after 14th month.

Nervus Tibialis: Gastrocnemius, tibialis posticus, flexor digitorum longus, 7th month. Other muscles after 10 months. Intrinsic muscles of the foot not recovered.

Nervus Peroneus: Peroneus longus, tibialis anticus, after 8th month. Extensor digitorum longus after 10th month. Extensor hallucis after 16th month.

All these dates indicate the beginning rather than completion of regeneration

Suture in partial resection 46 cases. Re-examined 35 cases. Of these 29 cases or 83% showed return of function at least of one muscle.

Relation of resection to time elapsed at operation (suture).

One to three months: Distinct improvement 66%, slight improvement 14% (21 cases).

4 to 6 months: Distinct improvement 50%, slight improvement 32% (46 cases).

7 to 22nd month: Distinct improvement 24%, slight improvement 50% (69 cases).

C. Bridging. Edinger method, i. e. use of serum agar tubes, applied in 27 cases of which 22 were re-examined. Only one case showed improvement; Foramitti's method, the use of hard veins for insheathing the nerves, was applied in 32 cases of which 17 were re-examined. Of these 17 cases 9 gave positive results, or 60%. The bridge amounted from 3 mm. to 12 cm. Distinct results however were only obtained in a gap less than 3 cm.

D. Transplantation. Transplantation was carried out in 11 cases. The transplanted gap amounted to 5½ to 8 cm. No results were obtained.

E. Splicing of Nerves. 4 cases. Method consisted in implantation of normal nerve laterally into the paralyzed one. 2 cases are reported having given results. In one case a branch of the median nerve was implanted into the musculo-spiral nerve. Active extension of the wrist was obtained after 18 mo. In another case there was an implantation of the 7th root into the 6th root with regeneration of the intrinsic hand muscles after 25 months.

F. Direct Neurotization. All attempts at direct neurotization gave no results. Dynamometric measurements of the muscle energy of recovered muscles show that even in favorable cases the power regained was not more than 1/12 to 1/3 of the normal.

Sensory disturbances in successful operation are usually improved but not entirely relieved. The temperature sense was rarely re-established. Trophic destructions are improved. Ulcerations are more frequent of the foot than the hand. In 3 cases of sciatic nerve paralysis trophic changes of the bone and sequestration of the metatarsals was absolute.—*A. Steindler, Iowa City, Iowa.*

THE IMMEDIATE STERILIZATION AND CLOSURE OF CHRONIC INFECTED WOUNDS. By W. Wayne Babcock, M. D., Philadelphia. *Jour. A. M. A.*, Vol. 74, No. 19, 6-8-20.

With the mass of the chronic infections of war, the aim of the Carrel-Dakin treatment—the early closure of the wound—has not been attained.

A treatment successful in the hands of highly skilled enthusiasts may fail in routine use when it exacts infinite care as to detail over prolonged periods of time, and when it is adapted only to selected cases and requires repeated operations and multiple dressings at times most painful.

We have sought an agent for chronic pyogenic infections that would do rapidly, under adverse conditions and in one operation, what the Carrel-Dakin treatment does so slowly under the most favorable circumstances, and with two or more operations.

A number of chronic ulcers, some previously treated by skin grafting, and several infected hernia wounds, healed primarily after sterilization, incision and suture. The bone infection cases were unselected, had a variety of infecting micro-organisms and included the worst cases at Fort McPherson. In but one case was the bacterial count below infinity. All had from one to nine sinuses, and had had from two to eight previous operations. Some had multiple sequestra, complete fracture, associated abscesses, and joint or periosteal complications. The duration of the disease had been from seven months to more than a year, part of which time there had been weeks and months of Dakin treatment. A few lacked skin preparation when brought to the operating room, and had purulent crusts and pustules.

The osteomyelitis most frequently involved the tibia and femur, but the pelvis, humerus, fibula, radius, tarsus and metatarsus, ribs, clavicle, scapula, and mandible were also treated. In two pelvic cases the peritoneum was opened, while the hip joint and the knee joint were each invaded five times from a previously purulent field.

With bone infections, devitalized and insufficient soft tissue, multiple and closely adjacent scars, complicated sinuses and hematomas have presented difficulties not found in the usual operation. The operative results could not be judged as after the usual aseptic operation. Tightly sutured wound edges not infrequently showed a limited necrosis. Accumulated secretions from the enormous wound surface often escaped thru the stitch holes or between the sutures. Stitch abscesses and spreading phlegmons were rare and usually all openings were closed and the wound healed at the end of six weeks. Of the first 100 cases only four have required reoperation, none of the older healed cases have relapsed, and present evidence is that a good technician should be able to overcome from 70 to 95% of his chronic bone infections by a single operation, percentage varying with the location, extent of the lesion, amount of viable soft tissue, and thoroughness of the operation.

In 350 cases, there was one death attributable to the operation. This occurred before the danger of injecting zinc chloride without a tourniquet was appreciated.

Technic,—The method consists of four procedures carried out in one operation under anesthesia:

1. Chemical sterilization of all sinuses and wound surfaces by the injection and application of a saturated solution of zinc chlorid.
2. Delineation of infected areas by the injection or application of an alkaline ethereal solution of methylene blue.
3. Mass excision of the entire area of infection.
4. Wound closure with the obliteration of all dead spaces.

Skin Preparation.—The wound area should be prepared by daily shaving, washing with soap and water, removal of all scabs and crusts, and the application of a 2% mercuric oxid in zinc ointment for three days preceding the operation.

Wound sterilization:—On the operating table, under local or general anesthesia, the skin is (a) thoroughly scrubbed with "B" solution, (b) painted with 3% solution of tincture of iodin, and (c) sterilized by a saturated solution zinc chloride which is thoroughly injected under pressure or packed with small moistened pledgets into all sinuses and cavities, applied to all unhealed and granulated surfaces, and rubbed very carefully over the scar and skin adjacent to the wound. Five minutes are allowed for the penetration of the zinc solution, great care being taken that every recess of wound is reached. If injected under pressure, the general circulation must always be protected by a tourniquet. The injection will not be made into fistulas connecting with the bladder, intestine or any other important viscus, nor will this method be used in the presence of erysipelas or other acute spreading infection or before the normal tissue barriers to sepsis have been erected.

Color Delineation.—The antiseptic staining solution is then applied to all eroded surfaces and injected under pressure or packed with cotton pledgets into cavities and sinuses. As soon as this solution has evaporated, the exposed granulating surfaces are left dark blue-black, dry, bloodless on manipulation, and sterile. If a section is made thru the sinus, it will be found that the coloring has penetrated to a depth of from 1 to 3 mm. Outside this is a much wider zone of avascular grayish white tissue that has been sterilized and devitalized by the zinc chloride. Some of the sequestra removed after the treatment from deep bone cavities have produced no growth on culture mediums.

ANTISEPTIC STAINING SOLUTION

Saturated alcoholic solution of methylene blue	20 Gm. or C.c
Caustic Potash	3
Phenol	5
Ether	to make 100

Excision of Infected Area.—The field is again painted with tincture of iodine, and a very free skin incision made, so planned as to permit later closure and to surround and to be well outside of all scars and sinuses, which are to be excised as nearly as possible en bloc. The instruments are now changed, the skin margins well separated from the adherent underlying tissues by traction with sharp retractors, and dry towel or gauze clipped in position to isolate the wound. The incision is now deepened to the bone, the periosteum is freely incised and retracted from entire circumference of bone, protected by towels or gauze, and, beginning some distance from the diseased area, with sharp chisels, the infected bone is freely excised with the attached underlying skin, scars and sinuses. Care is taken not to divide the bone completely, but the healthy medullary cavity should be freely exposed. A blue color indicates that all infected areas have not been removed and that the incision is to be continued. The operator should use very sharp knives, gouges and chisels, and work centripetally from outside the septic focus, rather than with curets, which tempt one to work from within out. All soft tissues and bone should be removed to a distance of at least 1 cm. beyond the bone coloration.

Scars.—As a rule, the scar is excised.

Large Bone Defects.—These, especially if near the articular ends, may be filled with pediculated flaps of muscle or other soft tissue, or lined by large

pediculated thick skin flaps. The inward transposition of the head of the tibialis anticus and extensor longus hallucis is useful for filling large defects of the head of the tibia. The defects left by removing skin flaps may be closed by plastic operation or skin grafting. If there is a complete fracture, the bone ends should be beveled to chisel edges and appropriate extension and immobilization should be maintained in the after-treatment.

Multiple Sinuses.—These should be excised. If left, the entire sinus tract will usually later be expelled in the form of a tube of necrotic tissue. To avoid secondary hemorrhage, no zinc infiltrated tract should be left adjacent to a large blood vessel.

Secondary Hematomas.—Bleeding from bone may be controlled by gauze pressure or by pressing bits of muscle into the bone. Bleeding from soft tissues should be carefully corrected by forcipressure, fine catgut ligatures, or sutures. A lateral stab or incision thru an adjacent scar may be left for drainage.

Wound Closure.—Muscles and soft tissues are sufficiently liberated from the skin and bone and each other to fit into the bone defects. If possible, the bone should be covered with a layer of muscle and aponeurosis as well as skin. Muscles should be well freed and sutured with the edges inverted and rolled in so as to fill all bone cavities or depressions. Plain catgut sutures are used to unite the deep tissue layers, and the skin is closed with an inverting mattress suture of silkworm gut. Only a dry technic is employed. A sterile 10% solution of sodium bicarbonate is kept at hand to neutralize the zinc chloride in case of accident.

After-Treatment.—The early dressings should be copious and should give supporting pressure. Wet, nonirritating, antiseptic dressings are applied for the first week and until all tissue reaction has subsided. For this purpose Solution "C" is used which is injected into the gauze dressings thru incorporated rubber tubes every two to four hours. The part is well supported and is kept quiet, elevated and warm.

SOLUTION "C"

Chloral Hydrate	1 Gm or C.c
Alcohol	10
Glycerin	25
Saturated Solution of boric acid	65

The adjacent skin is to be kept clean and coated with 2% yellow mercuric oxide ointment.

Unless the surgeon can prevent the entrance of the zinc chloride into the general circulation during and for five minutes after the injection, and unless he is able to excise freely all chlorided tissue adjacent to the important structures, he should not employ the method.—*Leo. C. Donnelly, Detroit.*